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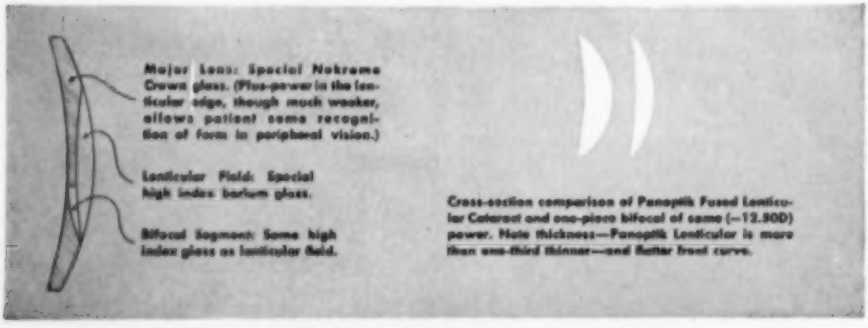

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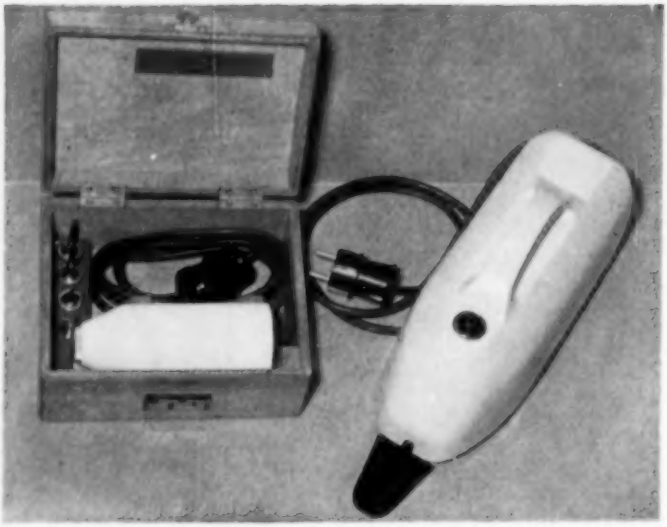

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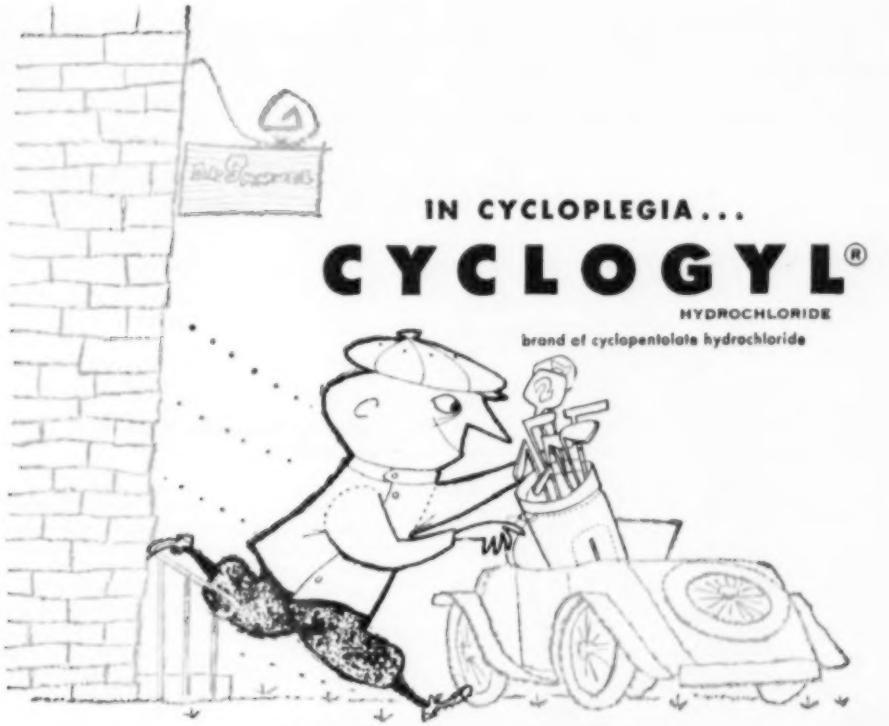

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1. Gordon, D. M., and Ehrenberg, M. H.: Am. J. Ophth. 38:831 (Dec.) 1954.

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AMERICAN JOURNAL OF OPHTHALMOLOGY

VOLUME 39 MARCH, 1955 NUMBER 3

THE STATUS OF LENTICULAR OPACITIES CAUSED BY ATOMIC RADIATION*

HIROSHIMA AND NAGASAKI, JAPAN, 1951-1953

ROBERT M. SINSKEY,† M.D.
Durham, North Carolina

(With illustrations by Geoffrey Day‡)

On August 6, 1945, an atomic bomb was dropped on Hiroshima, Japan. Three days later a second atomic bomb was exploded over Nagasaki, Japan. Owing to the critical situation at the time, including lack of personnel and equipment, major surveys of the biologic effects of nuclear radiation were not undertaken for several years. However, Flick[1] reported fundus lesions in survivors with acute radiation sickness. These were considered to be secondary to the blood dyscrasias produced by whole body radiation.

In 1947 by presidential directive, the Atomic Bomb Casualty Commission was set up to study the late radiation effects in the survivors of the Hiroshima and Nagasaki bomb explosions. It operates under the supervision of the National Research Council with funds supplied by the Atomic Energy Commission.

The first studies undertaken by this commission were in the field of hematology and genetics.[2] In September, 1949, stimulated by the discovery of radiation cataracts in some 10 American physicists, a team of ophthalmologists under Dr. David Cogan arrived in Hiroshima to investigate latent ocular injuries from exposure to nuclear radiation.[3] Dr. Cogan's survey revealed 10 heavily irradiated Japanese survivors with radiation cataracts.[4, 5, 10] At the same time radiation cataracts were reported by Dr. Hirose and Dr. Fugino in survivors.[6] In 1950, Dr. S. J. Kimura, Dr. Cogan's co-worker, reported 90 more survivors with radiation cataracts.[7-9]

This present report concerns an intensive investigation of 3,700 exposed and nonexposed individuals from May, 1951, to December, 1953. Only with the complete co-operation of the Japanese people and their local and national governments could such a comprehensive survey have been accomplished.

The investigating team consisted of an ophthalmologist (the author), an interpreter, three Japanese nurses, numerous Japanese social workers, the Atomic Bomb Casualty Commission, Biostatistical Department under Dr. Lowell Woodbury and, of course, guidance from the director and research director of the Atomic Bomb Casualty Commission, Dr. Grant Taylor and Dr. William C. Maloney.

At the beginning of this survey all previously diagnosed radiation cataracts were examined to familiarize ourselves with these lesions, and, hence, to be able to establish certain criteria for evaluation of the following:

* From the Laboratories of the Atomic Bomb Casualty Commission, APO 182, c/o Postmaster, San Francisco, California. This work was sponsored by the Atomic Bomb Casualty Commission, National Academy of Sciences-National Research Council, with funds supplied by the United States Atomic Energy Commission.

† Division of Ophthalmology, Duke University Medical School.

‡ Department of Medical Illustration, Atomic Bomb Casualty Commission.

1. The differential diagnostic problem of radiation effects on the lens.

2. The correlation between the lenticular changes caused by nuclear radiation and other factors, such as age, sex, epilation, distance and shielding.

3. Progression of these lesions caused by nuclear radiation.

4. Extent of present visual loss caused by nuclear radiations from these two atomic bomb explosions.

Differential diagnostic problem of radiation effects on the lens

Survivors with previously diagnosed radiation cataracts were brought in and examined with the slitlamp and ophthalmoscope. Nonexposed persons were also examined during the same period. Both of these groups had changes ranging from a few fine granules to large granular plaques with vacuoles under the posterior capsule of the lens, axially. For the most part, these could be detected only with the slitlamp (fig. 1).

In particular, elderly nonexposed and exposed persons were found not infrequently to have polychromatic granular plaques of various sizes under the posterior capsule. These were usually associated with the other senile changes; that is, posterior cortical sclerosis, increased relucency of the lens, peripheral wedge-shaped opacities, and water clefts (fig. 2). Of 12 nonirradiated persons with pigmentary degeneration of the retina, three had granular plaques on the posterior capsule indistinguishable from those seen in the exposed irradiated groups (fig. 3).

The finding of these morphologically similar lenticular opacities of obvious different etiologies presented the problem of determining the earliest clinically observable radiation changes in the lens. Since the lesions were similar in the exposed and nonexposed, this could be accomplished only by a statistical

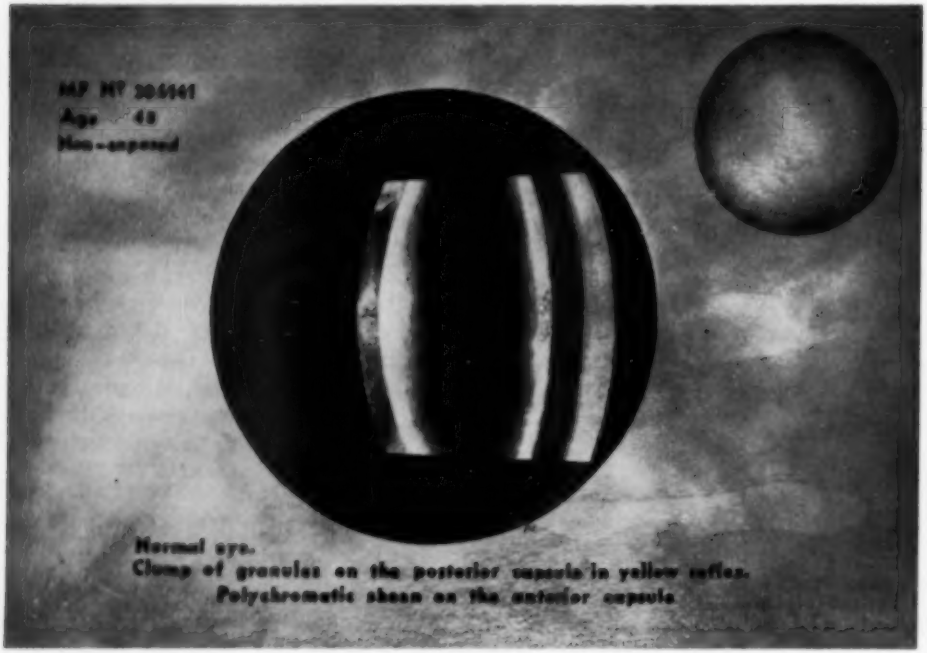


Fig. 1 (Sinskey). Slitlamp appearance of a normal eye.

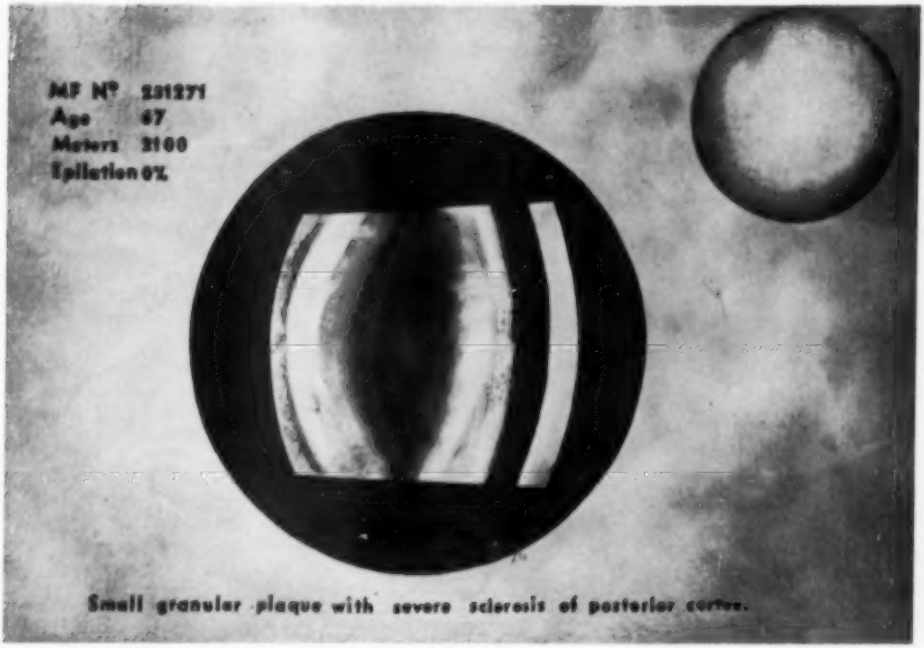


Fig. 2 (Sinskey). Slitlamp appearance of a senile eye.

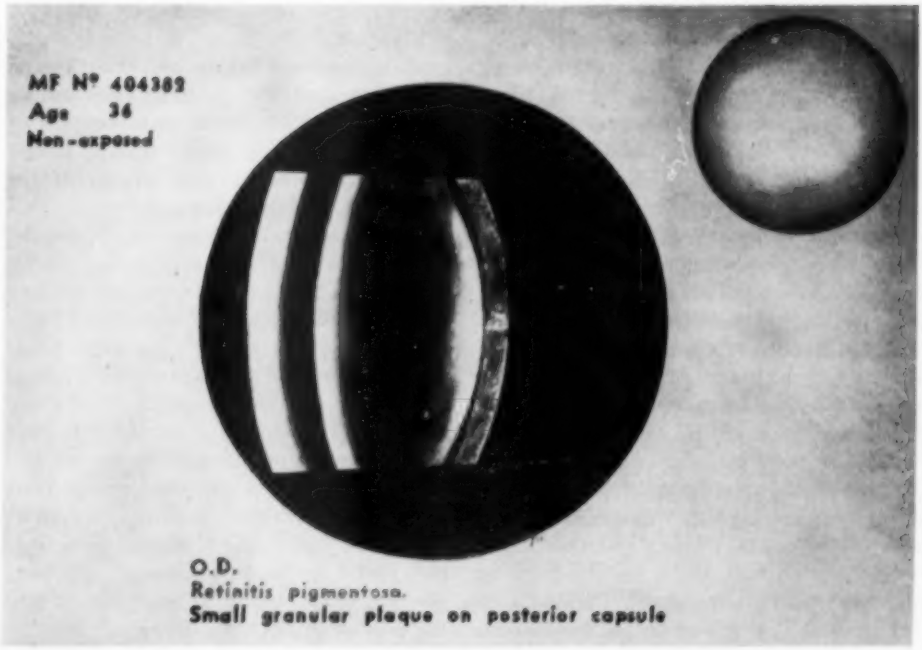


Fig. 3 (Sinskey). Slitlamp appearance of an eye with retinitis pigmentosa.

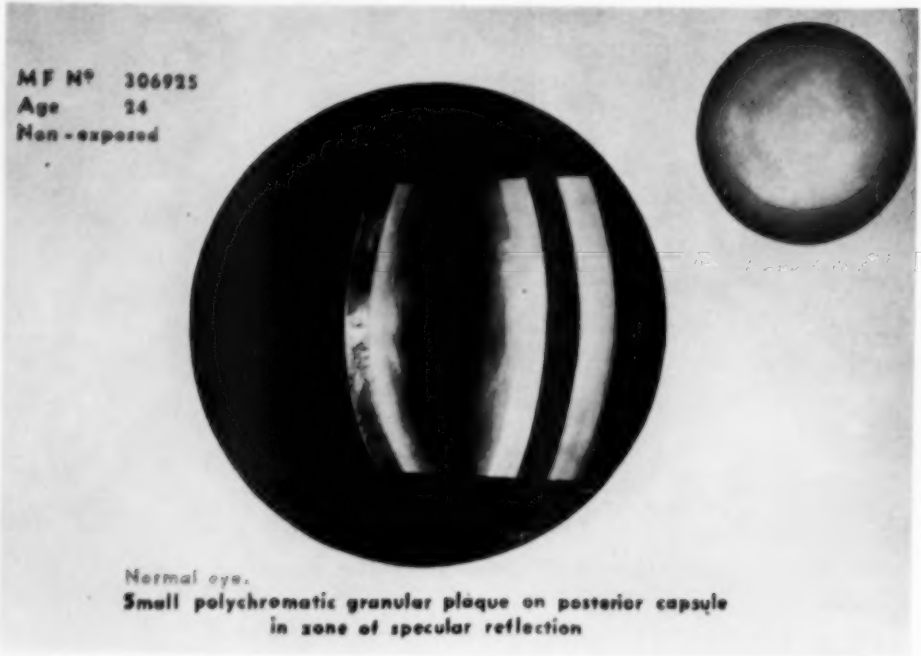


Fig. 4 (Sinskey). Slitlamp appearance of an eye with minimum positive atomic-bomb changes.

analysis. With this in mind, the following clinical experiment was designed. Two groups were selected with regard to balancing age, sex, geography, and the economic status as factors.

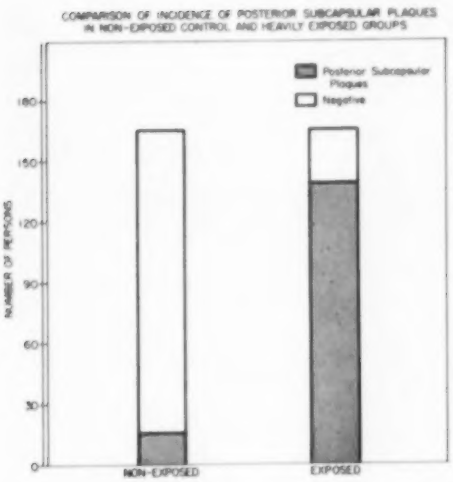
The first group consisted of survivors of the nuclear explosion, giving a history of 90 to 100-percent epilation, that is, amount of scalp hair which fell out one to three months after the explosion. It was felt that this was the most heavily irradiated group and would offer the best chances of obtaining positive results. The control group was not in Hiroshima during or shortly after the bombing.

In order to minimize bias in the resultant data, uniform procedures in the following order were carried out: visual acuities, dilation of the pupils, slitlamp and ophthalmoscopic examination, and a history check by the biostatistical department. Persons with a history or evidence of serious eye disease, nuclear or cortical opacities, senile or congenital, severe enough to prohibit adequate examination of the posterior subcapsular area, were excluded from both groups.

The presence of granules only in the posterior subcapsular axial region of the lens was not sufficient for a positive diagnosis. Minimum positive change was considered to be a definite tiny subcapsular plaque located axially as seen only with the slitlamp (fig. 4). This was an arbitrary division dictated by the investigator's experience.

The outcome of the examination of these two groups was quite revealing. Of 164 controls, 16 (10 percent) were found to have polychromatic granular plaques on the posterior capsule. In the exposed group, there were 139 (84 percent) positive cases out of 165. (The majority of these lesions were not visible by ophthalmoscope and were identical in appearance to the lesions seen in the control group. See Graph 1.)

The remarkably high percentage of sub-

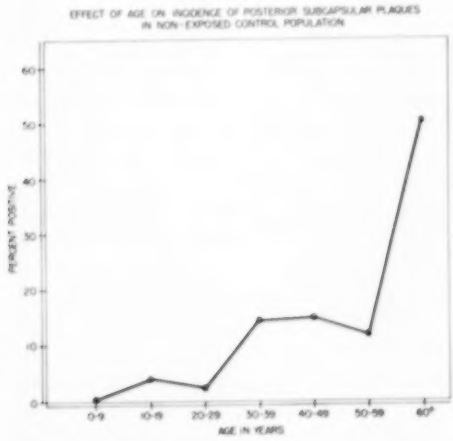


Graph 1 (Sinskey). Comparison of incidence in nonexposed and exposed groups.

capsular plaques in the exposed group was totally unexpected, since many of these people had been examined previously by this investigator and others with the slitlamp and recorded as negative.

At first it was felt that possibly these opacities were a recent development. However, re-examination of all the old charts revealed a small number of cases in which small polychromatic granular subcapsular plaques were recorded. These changes had been considered to be clinically insignificant by the observers.

The subcapsular plaques in these individual cases included in this controlled study had not changed in size appreciably since the previous examination. This plus the fact that over a four-year period there was little or no noticeable progression of even the most severe radiation cataracts, made this observer feel that these opacities were not a recent development. Historic evidence obtained from the more severely afflicted survivors indicates that visual loss began about two years after exposure.



Graph 2 (Sinskey). Effect of age on incidence.

Factors affecting incidence of posterior subcapsular plaques

Having established definite diagnostic criteria, larger numbers of survivors and nonexposed individuals were examined to determine the possible effect of age, sex, epilation, distance from ground zero, and shielding.

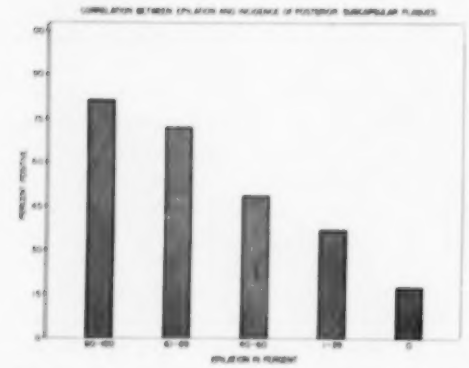
Age was a significant factor, particularly after the fifth decade (graph 2). Therefore, the age of cases selected was limited to 15 to 45 years. The lower limit was set to increase the accuracy of the radiation histories for distance, epilation, and shielding. Sex was not found to be a significant factor in either the exposed or control group.

There was a high correlation between these lenticular changes and epilation. The percentage of positive findings fell with the drop in the degree of epilation (graph 3).

Graph 4 illustrates the effect of epilation, shielding, and distance on the incidence of posterior subcapsular plaques. Epilation is graduated into none and partial; shielding is light and heavy. It is readily apparent that shielding and distance reduces the incidence of lens changes.

Stages of development of lenticular opacities caused by nuclear radiation

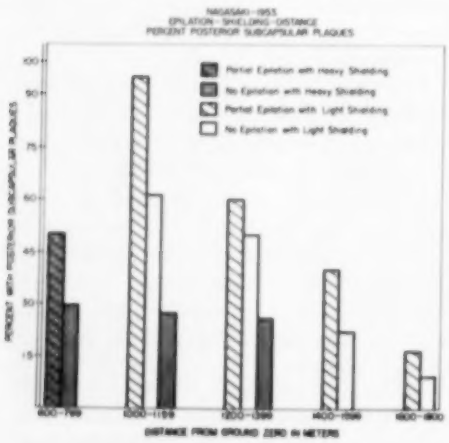
During the course of this investigation various stages in the development of these



Graph 3 (Sinskey). Percentage of positive findings.

opacities were noted in this large series of survivors. On direct illumination with the slitlamp, the granular plaques on the posterior capsule axially, which this observer considers to be the earliest definitive sign of radiation effects in the lens, appeared to be a mass of fine white granules, occasionally having a bluish cast in younger individuals and becoming more yellow in the older cases. In the zone of specular reflection, the granular plaque reflects a highly polychromatic light giving the effect of an oil slick (fig. 5).

The plaques were amoeboid in appearance,



Graph 4 (Sinskey). The effect of epilation, shielding, and distance on the incidence of posterior subcapsular plaques.

both horizontal and vertical with one or more pseudopods. The more extensive lesions were lacelike, ground-glass, or even resembled fool's gold. These opacities on cross section with the very thin beam of the slitlamp contained many clear areas interlaced with fine white linear opacities, giving the impression of a mass of vacuoles (fig. 6). The accentuation of this may present the doughnut type of opacity seen in a few cases.[9]

In the more advanced cases streamers were present which appeared to extend into the posterior cortex, separating from the posterior capsule as they approached the equator of the lens by an intervening layer of normal looking lens cortex (fig. 7). This would seem to indicate that the lesion was relatively stable since the growing lens was pushing normal lens fibers down behind the posterior subcapsular opacities.

As a rule anterior subcapsular opacities become noticeable only in these later stages, and were separated from the anterior capsule by normal looking lens fibers in the younger survivors. Occasionally marked differences in the size of the lesion were noted in the two eyes.

Visual loss

The loss of vision resulting from changes in the lens caused by nuclear radiations from the atomic bomb in Hiroshima has been a much publicized and dreaded aftermath. In the total survey, there have been 154 survivors with posterior subcapsular plaques large enough to be visible with the ophthalmoscope. Those opacities not visible with the ophthalmoscope in the greater percentage of survivors can be excluded from consideration because they obviously do not decrease visual acuity under standard testing procedures.

Of the 154 survivors 129 can be corrected to 20/25. The remaining 25 survivors have less than 20/25 but all of these have serviceable vision with the proper correcting lenses.

Although some cases may have been overlooked, intensive search produced only four survivors who had operative procedures pre-

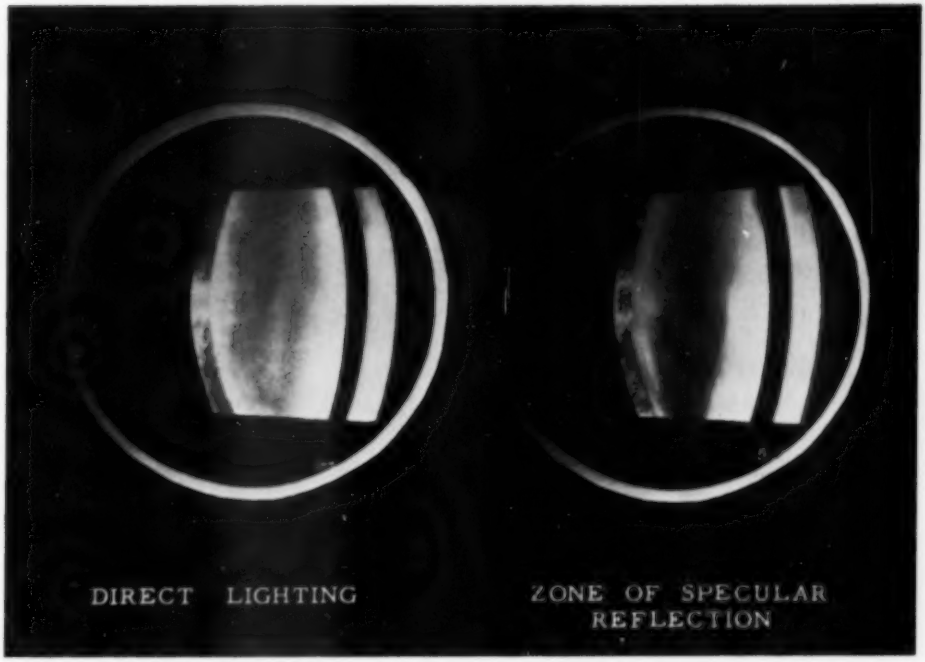


Fig. 5 (Sinskey). In the zone of specular reflection, the granular plaque reflects a highly polychromatic light giving the effect of an oil slick.

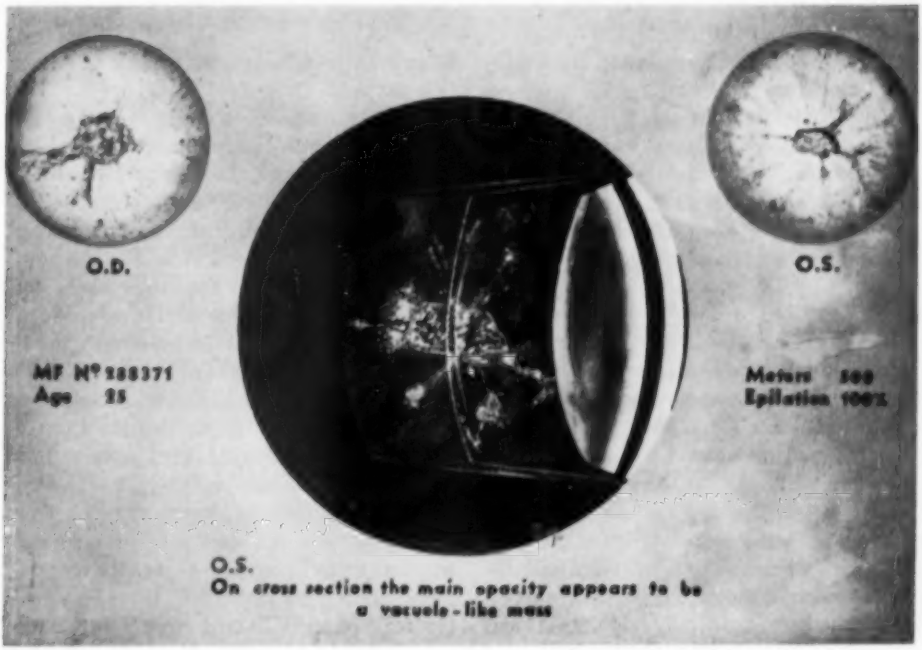


Fig. 6 (Sinskey). Appearance of opacities on cross section with the very thin beam of the slitlamp.

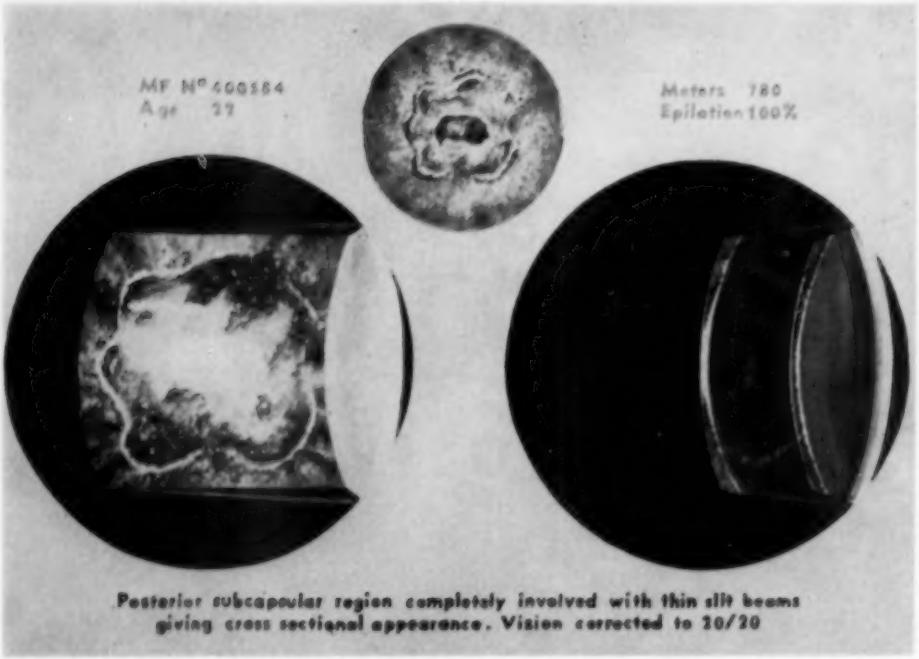


Fig. 7 (Sinskey). Slitlamp appearance in the more advanced cases.

sumably because of loss of vision from radiation effects on the lens.

In view of the relatively negligible effect of the atomic bomb on visual loss seven years after the bomb, the term cataract in this survey has been studiously avoided since it connotates severe loss of vision and even blindness to the average physician and to the laity.

Discussion

From these studies, it is readily apparent that the human lens is extremely sensitive to nuclear radiations. Of 425 survivors in Nagasaki between 400 and 1,800 meters from ground zero, 47 percent were positive, irrespective of epilation and shielding. Although the opacities in the vast majority of the cases are so insignificant as to be invisible with the ophthalmoscope, they are important in terms of dosimetry. Statistically significant lens changes are present in survivors without any other known early or late evidence of radiation damage.

With the tremendous progress in the conversion of atomic energy to useful controlled power production, hundreds of thousands and eventually millions of workers potentially will be exposed to nuclear radiations. It is important to recognize the earliest signs of radiation injury for the protection of the employees. Since these posterior subcapsular plaques are a relatively nonspecific type of reaction by the lens to injury, it is necessary to screen the workers before potential exposure to radiation. Even then the laws of probability would dictate that a certain number of cases would probably develop the posterior subcapsular plaques after employment, although not exposed to significant amounts of radiation. However, pre-employment screening would enable those responsible for radiation hazard control to have a certain base line from which to work.

Summary

1. Inconspicuous changes in the lens in the form of posterior subcapsular plaques, which have previously been interpreted as normal, are shown statistically to be significant effects of nuclear radiations from the atomic bombs dropped over Hiroshima and Nagasaki.

2. It is evident that morphologic characteristics of radiation cataracts may be confused readily with lenticular opacities of other etiologies which occur primarily in the post-subcapsular region axially.

3. The incidence of these posterior subcapsular plaques can be correlated with age, epilation, shielding, and distance from ground zero. Sex has no effect on incidence studies.

4. The posterior subcapsular opacities observed over a four-year period were increasing very slowly or not at all.

5. The various stages of opacification of the lens caused by nuclear radiation are described and illustrated.

6. The atomic bomb explosion in Hiroshima on August 6, 1945, has resulted in negligible loss of vision to date.

7. The utilization of the earliest signs of radiation changes in the lens as an additional method for the protection of the atomic plant worker is advocated.

Box 3802, Duke University.

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Ophthalmic Miniature

And, though of considerable length, the hair of the forehead does not hinder the horse from seeing but keeps away from its eyes what is noxious. Indeed, one must believe that the Gods have provided the horse with hair in place of the big ears with which they protected the eyes of donkeys and mules.

Xenophen,
Equestri de re equestri, 5, 6.

PRIMARY DRUSEN (HYALINE BODIES) OF THE OPTIC NERVE*

SAMUEL D. MCPHERSON, JR., LT. COMDR. (MC) USNR
Bethesda, Maryland

Hyaline bodies are small spheric masses which may occur either on the surface of the optic nerve, in its substance, or in the adjacent retina. Their origin is uncertain but they are considered to be congenital. They usually occur as bilateral lesions, may remain dormant, or may coalesce, calcify, and become associated with visual field defects. Because hyaline bodies may be associated with field defects and because they may at times simulate the appearance of choked disc, their presence should always be suspected in persons with questionable papilledema and unusual visual field defects.

Hyaline bodies may occur as part of a generalized neurologic disorder, for example, in tuberous sclerosis; as a result of optic atrophy, for example, in retinitis pigmentosa; or as an apparent primary disorder of the optic nerves.

HISTORICAL

Hyaline bodies of the optic nerve were first described by H. Müller[1] in 1858. Liebrich[2] was the first to report the clinical observation of drusen and he stated that in his case there was no reduction of vision. In 1883, Stood[3] described two cases with nodules on the temporal sides of both discs, good central vision, and contracted fields of vision. He referred to two cases reported by Nieder[4] and Jany[5] and stated that at that time there were four cases recorded in the literature. Since that time hyaline bodies of the optic nerves have been recorded on numerous instances in the ophthalmologic literature.

In 1903, Morton and Parsons[6] reviewed the histology of this lesion and concluded that hyaline bodies represent degenerative changes of exudates and are not related to the true drusen of Bruch's membrane from which their name was originally derived.

Coats[7] in 1912 stated that hyaline bodies could be distinguished histologically from corpora arenacea by their location and from corpora amylacea by the tendency of hyaline bodies to calcify, to become laminated, by the absence of a capsule, and by the failure of hyaline bodies to give a positive amyloid reaction. More recently Reese,[8] in a review of 14 cases in which histologic examination was possible, concluded that the lesion represented a "congenital excess of neuroglia which undergoes degeneration."

CLINICAL APPEARANCE

The appearance of the fundus with drusen of the nervehead varies with the location and depth of the drusen in the substance of the nerve. When superficial they appear as spheric, refractile bodies on the surface of the nerve. When the bodies lie deep within the substance of the nerve, the nervehead may appear elevated and resemble choked disc. Frequently, in these instances, one or more of the hyaline bodies may be partially seen lying at the neuroretinal margin. They are best seen with indirect illumination, by throwing the circle of light from the ophthalmoscope across one half of the nervehead and then looking at the opposite one half.

In other instances in which hyaline bodies lie deep within the nerve, the nervehead simply appears elevated and edematous and except for the lack of venous engorgement and tortuosity, the appearance is indistinguishable from that of papilledema. In these instances, the presence of hyaline bodies may be inferred from the presence of characteristic field defects, and the absence of other neurologic and ophthalmologic defects.

Various types of field defects have been

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described in individuals with hyaline bodies of the optic nerve. The reason for their occurrence is not clear but they do appear more common in instances in which the bodies lie deep within the nerve than when the bodies lie superficially upon the nerve. Rucker[9] in a review of the cases of hyaline bodies seen by him has described three types of field defects which may occur:

1. Enlargement of blindspots
2. Arcuate scotomas with either small fingers or large arms breaking through to the periphery
3. Peripheral contracture, usually below and nasally

In addition, Chambers and Walsh[10] have reported concentric constriction of the fields, central scotomas, and one instance of bitemporal hemianopsia. However, in the last instance, the patient had previously been diagnosed as having opticochiasmatic arachnoiditis and it seems possible that in this case hyaline bodies may have developed as the result of optic atrophy rather than as a primary lesion of the optic nerve.

It has long been recognized that hyaline bodies of the nerve may occur in association with other disorders of the eye. Their occurrence in instances of retinitis pigmentosa and optic atrophy secondary to other intraocular disease is well noted.[9, 11]

Van der Hoeve[12] has described the presence of hyaline bodies of the optic nerve in association with tuberous sclerosis or Bourneville's syndrome. This is a developmental disorder with a familial tendency characterized by multiple areas of cerebral sclerosis, adenoma sebaceum, retinal tumors, and hyaline bodies of the optic nerve.

Reese[8] in his excellent report on this subject concludes that hyaline bodies of the optic nerve may occur alone in persons who have subclinical or abortive forms of tuberous sclerosis. This is based on his observations of the genealogies of families with tuberous sclerosis in which one or more members may exhibit hyaline bodies of the optic nerve without other signs or symptoms of the complete syndrome.

It is the purpose of this paper to report three cases of hyaline bodies of the optic nerve which illustrate the three commonly seen clinical varieties of primary hyaline bodies of the optic nerve:

1. Those with hyaline bodies and no symptoms
2. Those with hyaline bodies and ocular symptoms
3. Those with hyaline bodies and ocular and sensory symptoms but with no neurologic findings

Case reports

Case 1

J. S. B. was first seen in the eye clinic, the U.S. Naval Hospital, Bethesda, Maryland, on July 25, 1954. The patient came in for routine refraction and had no specific complaints referrable to his eyes or central nervous system. There was no family history of neurologic or ophthalmologic disorder.

Examination. General physical examination revealed a healthy, well-nourished 25-year-old man with positive findings restricted to his eyes.

Vision in each eye was 20/25. Cycloplegic refraction was: R.E., −0.5D. sph. ⌒ − 1.25D. cyl. ax. 180° = 20/20; L.E. − 1.0 D. cyl. ax. 180° = 20/20.

External examination revealed normal extraocular movements, pupillary reactions, and tactile tension. The anterior ocular segments were normal on slitlamp examination.

On ophthalmoscopic examination the media were clear, both discs appeared slightly pale, blurred, and elevated one to two diopters. The neuroretinal margins were blurred and the physiologic cups were abolished. With indirect illumination both nerveheads seemed to be filled with numerous small spheric refractile masses which elevated the vessels on the nervehead and blurred the outlines (fig. 1). The maculas and peripheral fundi appeared entirely normal.

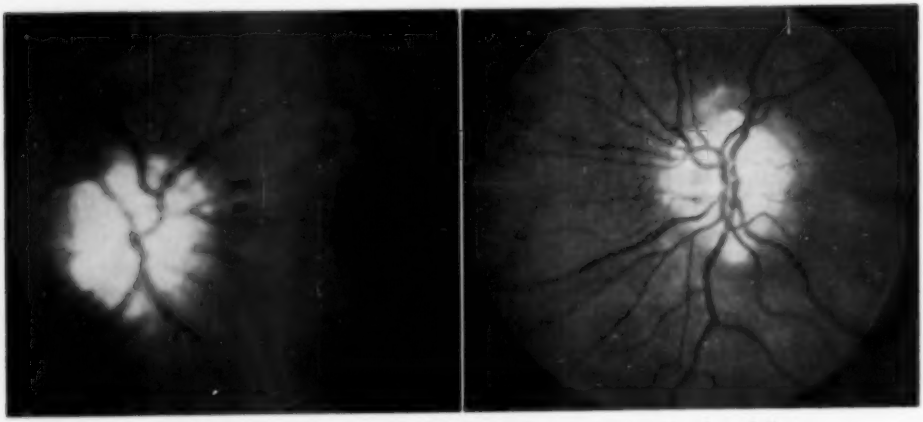

Fig. 1 (McPherson). Appearance of fundi in Case 1, showing blurring of disc outlines and filling of cups.

The peripheral fields showed a defect in the lower nasal quadrant of the right eye extending to within 10 degrees of fixation to three-mm. white at 330 mm. The left peripheral field was full throughout. The central field of the right eye showed an arcuate scotoma beginning at the blindspot and extending beneath the point of fixation to the nasal periphery to one-mm. white at 1,000 mm. The left central field showed an enlarged blindspot and a small relative paracentral scotoma below the point of fixation to one-mm. white at 1,000 mm. (fig. 2).

Laboratory examination. The Kahn test was negative and complete blood and urine examinations were also negative.

X-ray examinations. Anteroposterior and lateral X-ray films of the skull were completely negative with no signs of the changes of tuberous sclerosis.

Clinical course. The patient was followed closely for several months and there was no change in his clinical condition and no progression of his field defects. At no time did he develop any ocular or neurologic symptoms.

Case 2

R. M. W. was first admitted to the U.S. Naval Hospital, Bethesda, on September 25, 1953, with the chief complaint of blurred vision. The patient stated that for the past six years he had had episodes of blurred vision affecting one or both eyes. These attacks were said to come on suddenly and to persist for from 30 to 60 minutes. Following the attacks vision returned to normal. There were no accompanying systemic symptoms of nausea, vomiting, or headache. The last episode occurred five weeks prior to admission following three hours on the firing range and persisted for only a few minutes. Vision returned to normal with no sequelae. There was no family history of neurologic or ophthalmic disorder.

Examination. General physical examination revealed a healthy well-nourished 37-year-old man with no significant findings except for minimal benign prostatic hypertrophy.

Vision in each eye was 20/15 without correction. The extraocular movements, tactile tension, and pupillary reactions were entirely normal. Slitlamp examination revealed normal anterior ocular segments.

On ophthalmoscopic examination the media were clear, both discs appeared quite blurred, and there was obvious elevation of one to two diopters of both nerveheads. Both appeared to be of good color with irregular roughened surfaces. The physiologic cups were abolished. With indirect illumination

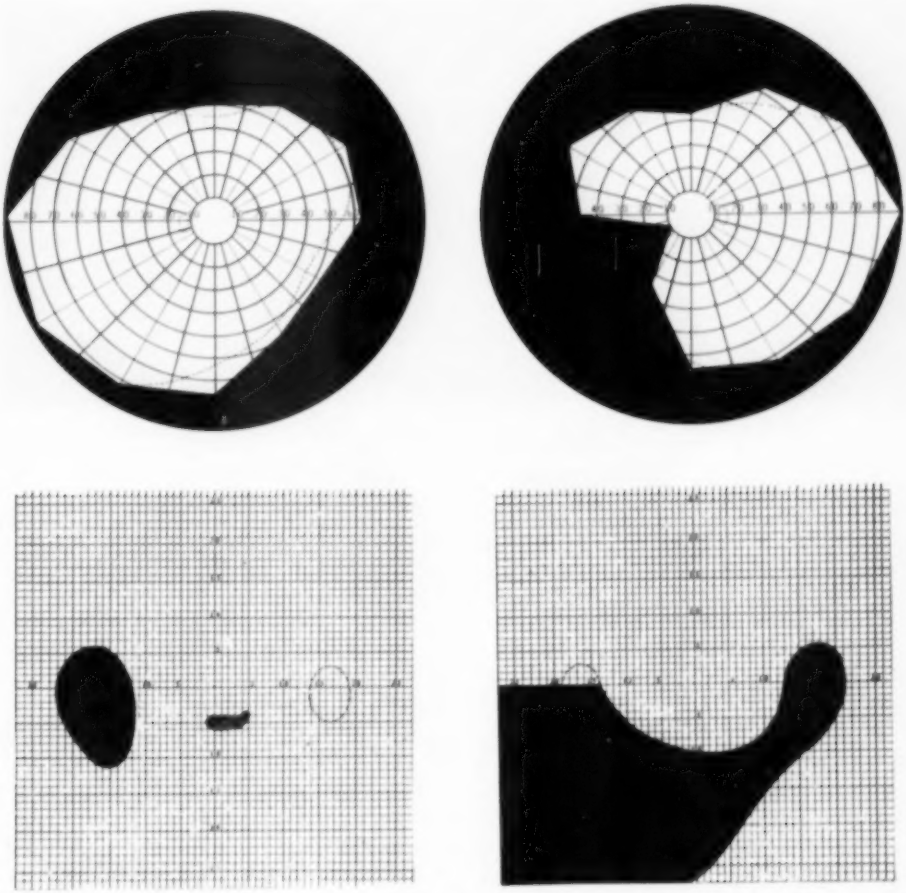

Fig. 2 (McPherson). Visual fields of Case 1, showing an arcuate scotoma in the right eye and enlargement of the blindspot in the left eye, with a small, relative paracentral scotoma.

the nasal sides of both nerveheads could be seen to be filled with numerous spheric refractile bodies, extending from the middle of both discs to the neuroretinal margins and blurring both margins. The retinal vessels were displaced and elevated over the masses (fig. 3). There was mild venous pulsation but no engorgement or undue dilatation. The maculas and peripheral fundi appeared normal throughout.

The peripheral fields of vision showed defects in the upper nasal quadrants of both fields to three-mm. white at 330 mm. In the right eye the cut extended to within 38 degrees of fixation and in the left eye to within 18 degrees. Central fields of vision revealed an enlarged blindspot in the right eye with a defect in the upper nasal quadrant extending to within 12 degrees of fixation. In the left eye there was an arcuate scotoma originating at the blindspot and arching above the point of fixation to extend to the periphery (fig. 4). Tension, taken on five different occasions, in each eye was 14 mm. Hg with the Schiøtz tonometer.

Laboratory examinations. The Kahn test

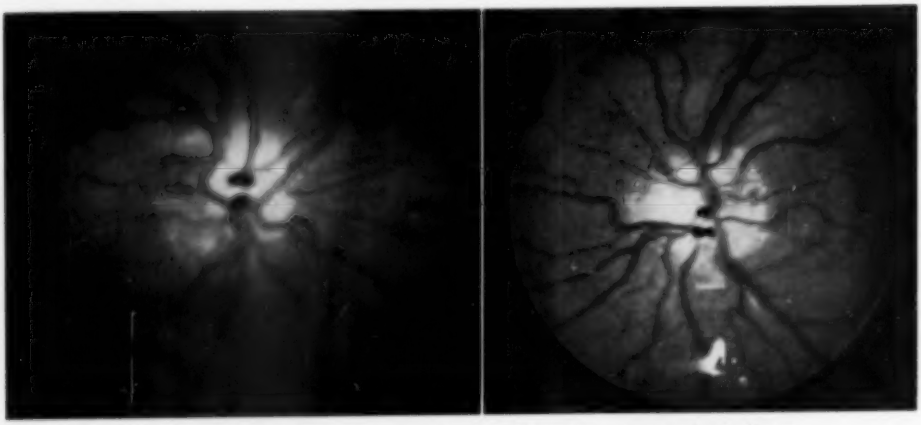

Fig. 3 (McPherson). Appearance of fundi in Case 2, showing hyaline bodies at the nasal border of both discs.

was negative. Complete blood and urine examinations were negative. The cerebrospinal fluid was clear and there were only five cells present. Cerebrospinal fluid chemistries were within normal limits.

X-ray examinations. Examinations of the chest, skull, sinuses, and orbits were entirely negative.

Clinical course. The patient was seen in consultation by the neurologic service and it was their opinion that he might have some type of migraine equivalent. There were no objective neurologic findings. An electroencephalogram was done and this was reported as showing a "minimal generalized abnormal EEG."

The patient was placed on a daily dose of 100 μg. of vitamin B_{12} empirically. He was discharged to duty on October 15, 1953. When last seen, two months later, there had been no objective change in his condition and no further attacks of blurring of vision. The patient's father and three children were examined for similar lesions but none could be demonstrated.

CASE 3

M. H. P. was first admitted to the U.S. Naval Hospital, Bethesda, on June 26, 1953, with the chief complaint of blurred vision, left eye. The patient stated that two months previously, while serving at sea, he first noticed numbness of his tongue, the right side of his face, and right arm. At the same time he also noted blurring of vision in the left eye. There was no family history of neurologic or ophthalmologic disorder.

He reported immediately to sick bay and was transferred to the Naval hospital, Yokosuka, Japan, because of "bilateral papilledema."

Visual field studies at that activity revealed a defect in the inferior nasal quadrant of the left eye. This did not change while the patient was under observation and, shortly after admission, ventriculograms, pneumoencephalograms, and spinal-fluid studies were done. All of these studies were reported as negative. Electroencephalogram was reported as showing "border line abnormality." The patient was transferred to the naval hospital, Oakland, California, and then to this activity on the neurologic service.

Examination. General physical examination on admission revealed a well-nourished, healthy appearing 21-year-old white man in no distress. Examination was completely negative except for the presence of well-healed incisions over occipitoparietal burr holes.

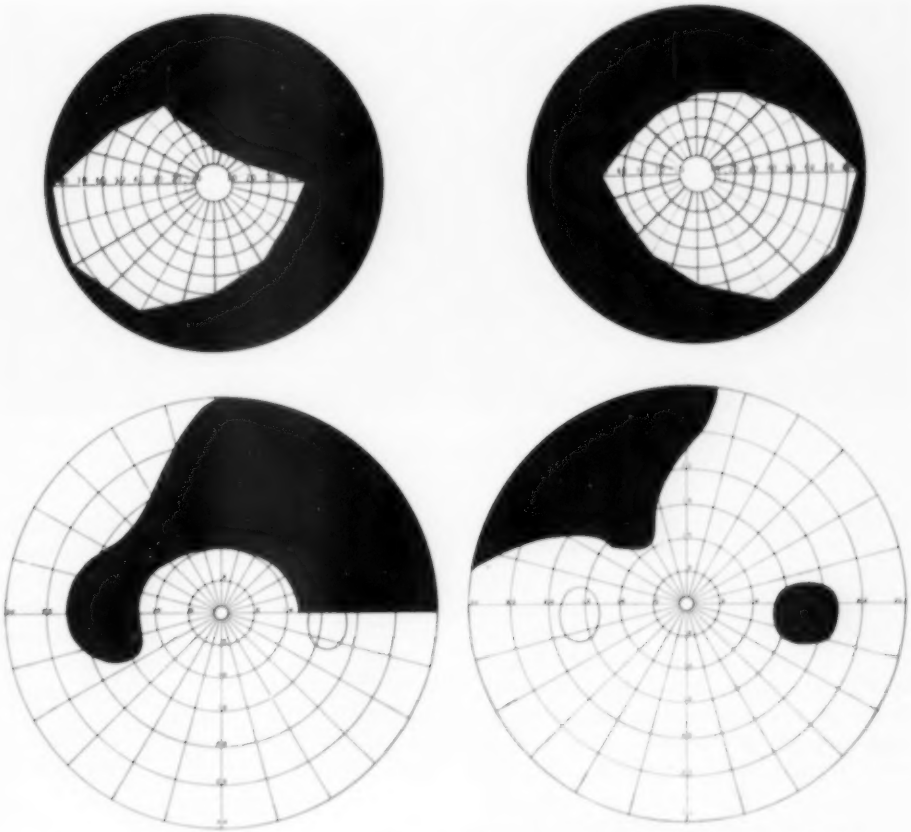

Fig. 4 (McPherson). Visual fields of Case 2, showing superior nasal defects in both eyes, with enlargement of the blindspot in the right eye and an arcuate scotoma in the left.

Neurologic examination done on admission was completely negative except for the fundi. It was the opinion of the neurologist that the sensory phenomena and the slight headache of which the patient complained might be explained on the basis a variant of migraine.

Vision in the right eye was 20/15 and in the left eye 20/40+3.

External examination was normal for extraocular movements, pupillary reactions, and tactile tension. Slitlamp examination revealed normal anterior ocular segments.

On ophthalmoscopic examination the media were clear. Both discs were of normal color but quite blurred and appeared elevated one to two diopters. This was confirmed with the binocular ophthalmoscope. The physiologic cups were abolished. At the superior nasal margin of the left optic nerve-head two small spheric refractile bodies could be seen with indirect illumination. None could be seen either in or on the right disc. The neuroretinal margins appeared blurred and this seemed primarily due to the degree of elevation. The retinal veins did not appear to be dilated or tortuous and there was no obvious retinal edema. There was absence of the foveal pit reflex in the left eye but otherwise the maculas and peripheral fundi appeared normal (fig. 5).

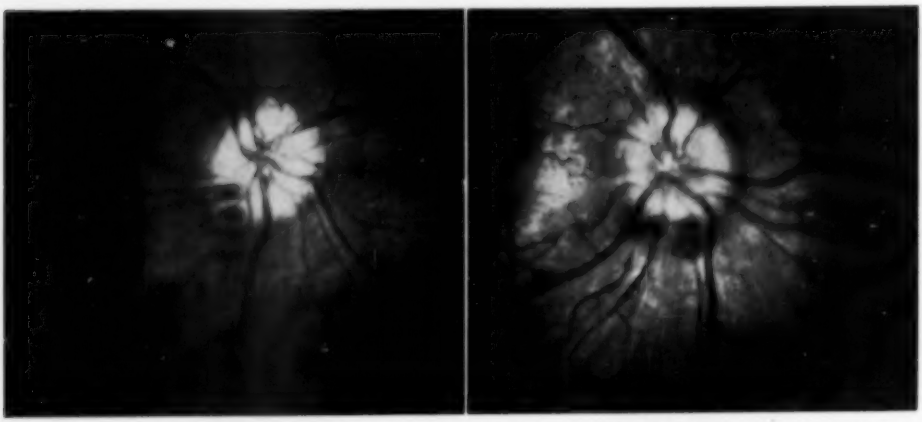

Fig. 5 (McPherson). Appearance of the fundi in Case 3, showing the similarity to papilledema of the right fundus and the more obvious drusen in the left optic nerve.

The peripheral field of vision was full in the right eye to three-mm. white at 330 mm. In the left eye there was a defect in the lower nasal field of vision extending to within 15 degrees of the point of fixation. In the right eye the central field of vision showed an enlargement of the blindspot and in the left eye there was an arcuate scotoma beginning at the blindspot and arching beneath the point of fixation out to the nasal periphery (fig. 6).

Laboratory examinations. The Kahn test was negative. Complete blood and urine examinations were negative. The cerebrospinal fluid was clear and there were only five cells present. Spinal fluid Kohlmer and Kahn were negative.

X-ray examinations. Examination of the skull was not remarkable except for the presence of trephine openings in the posterior parietal area with a minimal degree of calcification within the inner table of the skull which was thought to be of no significance. Bilateral carotid arteriograms revealed "normal vessels in size and distribution without evidence of displacement or aneurysm."

Clinical course. The patient was kept in the hospital for several months for observation. During that time there was little change in his signs or symptoms. He continued to have some vague generalized headache which was not disabling. Vision in the left eye varied with each examination from 20/40 to 20/60. Visual field results remained essentially the same although there was possibly some slight further peripheral contracture of the left field. The patient was returned to full duty January 19, 1954, with his condition essentially unchanged.

Comment

Of the three cases of hyaline bodies of the optic nerve presented, the first one is presented as an instance in which the ocular lesions were present without any accompanying ocular or systemic symptoms and certainly is illustrative of the majority of cases of this disorder which occur. In this case the nature of the disorder might well have been recognized by the presence of characteristic field defects without visualizing the actual bodies in the discs.

The second case is presented as an example of hyaline bodies of the disc causing ocular symptoms disturbing to the patient, without any accompanying neurologic symptoms and with ocular findings which were hardly more

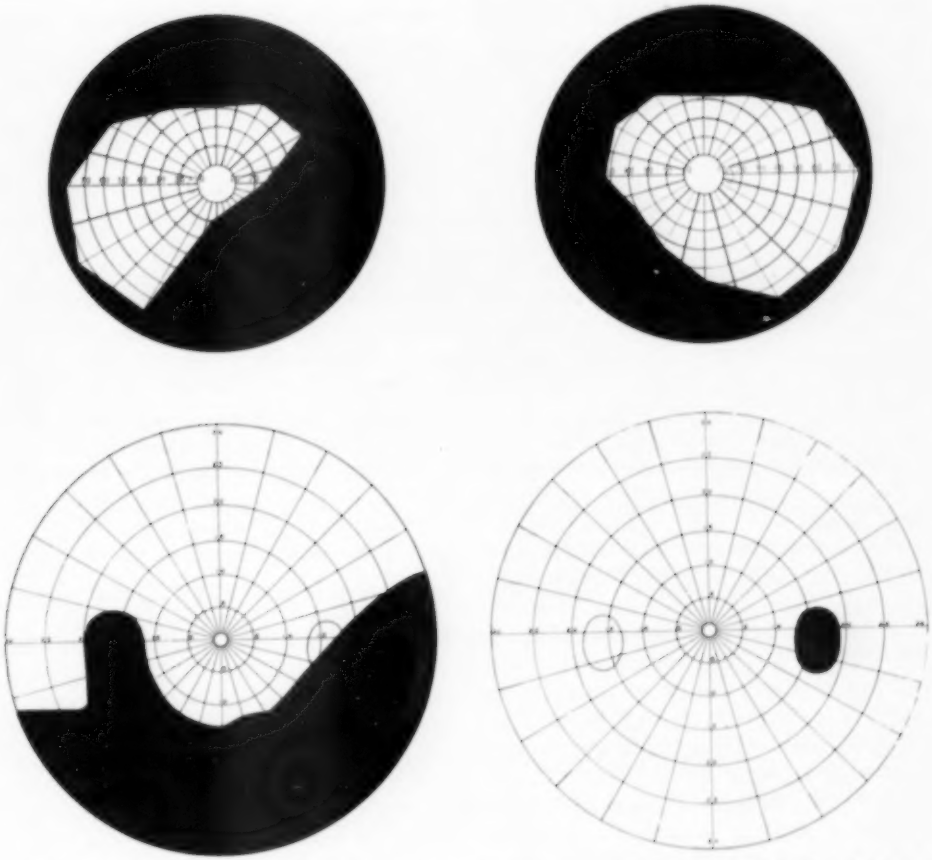

Fig. 6 (McPherson). Visual fields of Case 3, showing a relatively normal field in the right eye, with a nasal defect in the left eye and an arcuate scotoma extending below the point of fixation to the periphery.

pronounced than those present in the first case. In the second case, one must assume that there had been some recent increase in the size of the lesion within the optic nerve to give rise to the recent symptomatology. In support of this idea Reese[9] has reported the observation of fresh hemorrhage occurring over the disc in an instance of hyaline bodies of the optic nerve, and Walsh[10] has noted a progression of field changes.

The last case is presented as an instance of hyaline bodies with ocular and sensory symptoms suggestive of generalized neurologic disease but with no neurologic findings. In view of the patient's many sensory phenomena, one might consider this an instance of abortive or subclinical tuberous sclerosis as described by Reese.[8] However, in spite of an intensive neurologic evaluation including ventriculograms, we were never able to demonstrate any etiology for his multiple neurologic symptoms.

In all cases the possible presence of papilledema could be excluded by the use of indirect illumination in the examination of the fundi and by the presence of characteristic

field defects of hyaline bodies of the optic nerve.

SUMMARY

Three cases of primary hyaline bodies of the optic nerves are presented illustrating the three clinical varieties of this disorder as it occurs without accompanying ocular or neurologic disease.

EENT Service.

The opinions expressed herein are those of the author and do not necessarily reflect the views of the U. S. Navy Medical Corps.

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OCULAR MOLLUSCUM CONTAGIOSUM*

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New York

Molluscum contagiosum is one of the most easily overlooked causes of chronic unilateral conjunctivitis refractory to routine treatment. Classic molluscum nodules should present no diagnostic difficulties. In the region of the eyelids, however, they often assume an atypical appearance. Thus they are easily confused with sebaceous cysts and similar harmless lesions. This is particularly likely to happen when the lesion is not situated on the lid margin but, instead, occurs some distance away from it. Here the flatter, nonumbilicated lesions are even less suspect as a cause of ocular inflammation. Diagnosis is further complicated by the fact that the ocular sequelae assume a number of forms. This variance of clinical findings in ocular molluscum contagiosum has apparently not received the emphasis it deserves.

Although molluscum contagiosum does not appear to be a common eye disease, it probably occurs more often than we realize. Gifford and Gifford[1] felt that the ophthalmologist should see a case every year or two. Elschnig[2] reported its incidence as four cases per 10,000. In the records of the Manhattan Eye, Ear, and Throat Hospital, there have been but six pathologically proven cases of this disease with ocular complications in the past 12 years. This figure does not accu-

* From the Service of Dr. Byron Smith at the Manhattan Eye, Ear, and Throat Hospital. Read before the New York Society for Clinical Ophthalmology, February 1, 1954.

rately reflect the incidence, however. Pathologic confirmation of diagnosis is usually only requested in the more atypical cases.

Clinical picture

Molluscum contagiosum is classically described as a yellow-pink raised tumor of the skin measuring, on an average two mm. in diameter. Infrequently the mass may be brown or even reddish-black. The skin over the raised surface is stretched and shiny. The center is umbilicated with a minute orifice from which a cheesy white mass may be expressed.

Because of auto-inoculation, the lesions are frequently found in clusters. However, in the region of the eye, it is not uncommon for solitary lesions to occur.

The size of the nodule may vary from that of a fraction of a millimeter[3] to that of a tumor involving the entire lid.[4]

Umbilication is also exceedingly variable. Lesions of the eyelid, in particular, fail to show this feature. In other locations, especially away from the eyelid margins, the lesions tend to be larger and flatter, taking on the appearance of sebaceous cysts. The molluscum nodule can also resemble verrucae, milia, or small fibromas.

Molluscum contagiosum of the eyelids produces secondary inflammation of the eye which is presently believed to be a toxic reaction to desquamated virus material. These reactions take a number of forms. Generally, a moderately severe follicular conjunctivitis occurs. Papillary conjunctivitis, however, is not uncommon. A watery discharge is present, as in those conjunctivitides caused by the smaller viruses.

The most frequent type of corneal involvement consists of a punctate epithelial keratitis which closely resembles that of trachoma. These epithelial lesions are usually situated on the upper half of the cornea regardless of the location of the lid lesion.[5]

A pannus, occurring as a late manifestation of the disease, also bears a striking resemblance to that of trachoma. The occurrence of primary lesions of the conjunctiva[6] and cornea[7] are exceptionally rare.

Pathology

Molluscum contagiosum is almost universally considered a virus disease.[8] In recent years, however, Van Rooyen and Rhodes[9] have pointed out the possibility of a fungus etiology in view of its histologic resemblance to rhinosporidium. The molluscum virus is epitheliotropic and of large practical size.

As in the case of many other viruses, cell inclusion bodies are formed. These inclusions are acidophilic and cytoplasmic. The virus produces these bodies initially by infecting the epithelial cells of the malpighian layer. The more mature inclusions are later found in the lower stratum corneum.

These inclusions swell the epithelial cells which then assume a circular or pear-shape and measure between 20 and 31 microns in diameter. The nucleus is pushed to one side, as are the protoplasmic remains of the cell, by the expanding inclusion. Eventually nucleus and protoplasm disappear along with the intercellular spines, leaving a loose hyaline mass which is the molluscum body.

Under higher magnification, notably that of the electron microscope,[10] the inclusion is seen to be composed of a great many elementary bodies imbedded in their own matrix. These elementary bodies measure 360 by 210 millimicrons when mature and may be ovoid, lancet-shaped, or brick-shaped. They pass both Chamberland and Berkefeld filters and ultramicroscopy reveals them to consist of an outer formed cortex and a less dense interior.

Transmission of the disease is by direct contact and is said to occur only in man. The disease remains localized and there is an absence of general immunity. In most cases where the eyelids are involved the remainder of the body is free of lesions.

Laboratory diagnosis

A biopsy of the nodule or a smear of its contents stained with hematoxylin is the best

method of establishing the diagnosis microscopically. The demonstration of elementary bodies by Victoria Blue, Giemsa, or Loeffler's flagella stain is of definite diagnostic value but is considerably more difficult.

Scrapings of conjunctival epithelium in molluscum conjunctivitis will typically reveal a mononuclear cell response. While other types of follicular conjunctivitis due to viruses have a similar cellular response, as for example epidemic keratoconjunctivitis, Beal's conjunctivitis, and herpetic keratoconjunctivitis, only that due to verruca vulgaris is associated with lesions of the lid. Occasionally polymorphonuclear cells predominate in the scrapings but this is usually due to a concomitant bacterial invasion.

Pathogenesis

Desquamated virus material from the molluscum lid nodule has been incriminated as the causal factor producing the conjunctival and corneal inflammations of the disease. For the eyelid lesion to desquamate such material into the conjunctival sac, the lesion must be in close proximity to it.

Reports in the literature until now have emphasized the necessity for the primary lesion to be on the eyelid margin to produce these sequelae. This does not appear to be so.

A nodule in close proximity to the palpebral aperture may also cause ocular involvement. Lesions in the region of the cilia have been proven offenders. Furthermore, lesions situated in the folds of the upper lid which are brought into close contact with the eyelid margin when the eye is opened can produce typical secondary inflammations.

Report of cases

Case 1

J. M., a 66-year-old white man, entered the clinic at the Manhattan Eye, Ear, and Throat Hospital on February 6, 1951, complaining of recurrent inflammation of his right eye for two months. Several series of local treatments had been undertaken without success.

Examination of the right eye revealed a chronic follicular conjunctivitis with considerable mucopurulent discharge (figs. 1 and 2). On the skin of the lower lid some three mm. from the margin was a flat sebaceouslike lesion with a suggestion of umbilication. On the upper lid, four nodules were noted, the nearest of which was four mm. from the margin. Only one of these bore any resemblance to the typical molluscum nodule. No nodules were present on the margins of either lid.

The lesion on the lower lid and those two of the upper lid in closest proximity to the margin were excised and cauterized with three-percent tincture of iodine. A placebo drop was prescribed. Epithelial scrapings

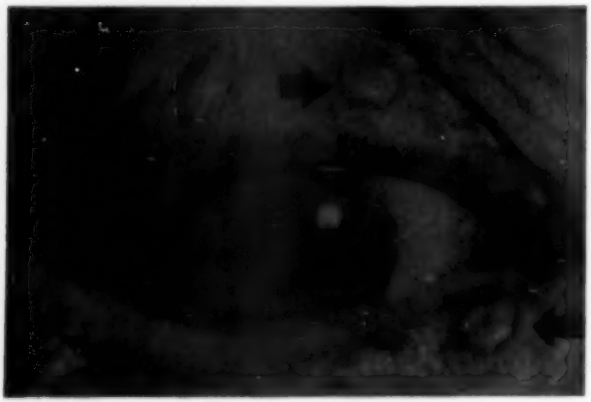

Fig. 1 (Curtin and Theodore). *Case 1.* Arrows point to two atypical molluscum bodies. In all, five were present on the eyelids, none involving the lid margins.

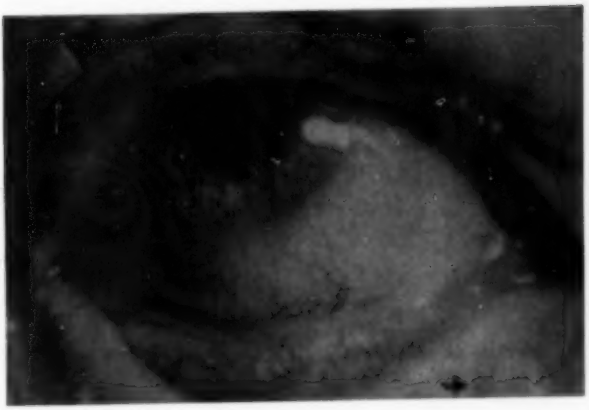

Fig. 2 (Curtin and Theodore). *Case 1.* Follicular conjunctivitis due to molluscum contagiosum. Small arrow points to nodule near lower lid margin which was removed first. For complete cure, it was necessary to remove other nodules distant from the lid margin (large arrow).

demonstrated a mononuclear-cell response. Microscopic examination of the contents of the nodules showed molluscum bodies. A slight improvement followed but the majority of inflammatory signs persisted.

The remaining two upper lid lesions had not been excised because one had the raised, flat yellowish appearance of a sebaceous cyst, while the other had the rough papillomatous appearance of a verruca. It was now noted that when the eye was held open both these lesions were in contact with the cilia and the ciliary border of the upper lid. On February 13th, both these lesions were excised. Both proved to be molluscum nodules on microscopic examination. A dramatic recovery and permanent cure immediately followed.

This case demonstrates the necessity for careful external examination in cases of chronic unilateral conjunctivitis. This examination should include a thorough inspection of the lid margins, cilia roots, and skin of the eyelids. All suspicious lesions should be excised. At the same time an investigation should be made of the canaliculus for streptothrix concretions,[11] the lacrimal sac for subclinical infection,[12] and the meibomian glands for deep suppuration.

Case 2

B. S., a 16-year-old white girl, is reported through the courtesy of Dr. Marvin Gillman. This patient presented a severe chronic follicular conjunctivitis of the lower lid (fig. 3) and a most unusual follicular hypertrophy of the bulbar conjunctiva (fig. 4) secondary to

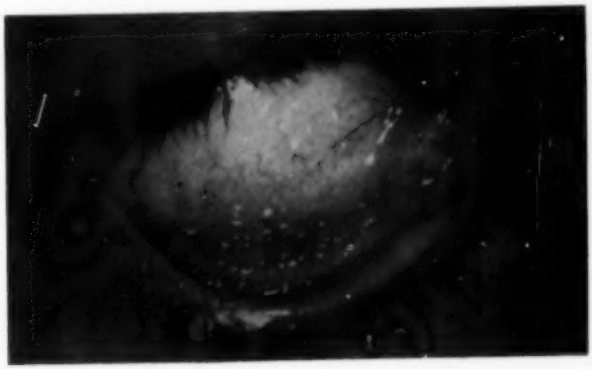

Fig. 3 (Curtin and Theodore). *Case 2.* Severe follicular conjunctivitis secondary to molluscum contagiosum of the lid margin.

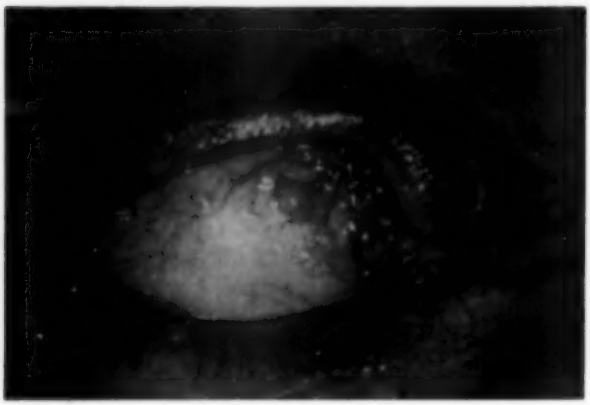

Fig. 4 (Curtin and Theodore). *Case 2.* Upper lid retracted, patient looking down. Unusual follicle formation, bulbar conjunctiva and upper fornix.

a classic molluscum nodule straddling the ciliary border of the lower lid margin. Preauricular adenopathy was noted.

After removal of the nodule, immediate remission of symptoms followed but it required six months for the follicles to resolve completely.

This patient demonstrated that a nodule on the lower lid may result in a reaction extending to the upper fornix. The case further shows that a proliferative lesion, such as a follicle, cannot be expected to regress rapidly with the removal of the inciting cause. Hence the persistence of follicles has no bearing upon the efficacy of the therapeutic regime.

Treatment

The presently accepted treatment of molluscum contagiosum is local excision and cautery. The lesions are incised, expressed, and the base touched with three- to seven-percent tincture of iodine, or trichloracetic acid. Electrodesiccation may also be used.

In recent years there have been an increasing number of reports on the effectiveness of chemotherapeutic and antibiotic compounds in the treatment of this disease. Sulfapyridine,[13] sulfadiazine,[14] aureomycin,[15–17] and terramycin[18,19] have all been reported efficacious. They are said to be of greatest value in those cases in which local excision would be impractical, due either to the number of lesions or the age of the patient. In addition to such systemic therapy, one cure has been claimed with the local use of aureomycin ointment.[20] However, in spite of the large number of these reports, only a small total number of cases have been so treated. Furthermore there are several reports which indicate that these compounds are not always successful.[17,21,22]

Antimolluscum vaccines have had considerable experimental trial but appear to be of no value. Ultraviolet and X-ray therapy have had some degree of success but are of limited value to the ophthalmologist.

Summary

Ocular molluscum contagiosum is easily overlooked as a cause of chronic unilateral conjunctivitis.

The primary lid lesion varies greatly in appearance and may resemble a verruca, sebaceous cyst, milium, or fibroma. It is capable of producing either a follicular or papillary conjunctivitis as well as a superficial punctate keratitis, and pannus.

The nodule need not be situated on the lid margin to produce these sequelae. Lesions occurring at some distance from the ciliary margin as well as those in the folds of the

upper lid can produce severe secondary ocular inflammation.

The treatment of choice for ocular involvement still appears to be local; that is, removal either by incision, expression, and cauterization, or else, by total excision.

651 Madison Avenue (21).
667 Madison Avenue (21).

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Ophthalmic Miniature

If a wind rises suddenly in the plain regions (of Africa), void of living creatures, and stirs the sand from the ground, the sand, agitated by great force, fills the mouth and eyes, so marching is impeded due to the embarrassed view.

Sallust, Sugurtha 79.

POSTERIOR LENTICONUS*

Report of a case with histologic findings

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Posterior lenticonus is a defect in the shape of the lens at the posterior pole, taking the form of a sharply circumscribed conical or globular protrusion, and is distinguished from posterior polar cataract in that it is composed of clear material which is not demarcated from the rest of the posterior lens cortex. The lens condition is usually the only anomaly present and the defect is usually unilateral.[1, 4, 8, 12–14]

Opacities may be present in the region of the conus and the posterior zones of discontinuity may be distorted backward into the lenticonus (fig. 1) but the layers within the Y sutures are uninvolved. Because of this Ida Mann[8] feels that the anomaly must appear late in development, say not before the sixth month of fetal life. The capsule in most reported cases has been intact but sometimes reported thinned at the posterior pole.

The junction of the lenticonus with the lens is a regular discrete change in curvature which on ophthalmoscopic examination shows a brilliant circular reflex (fig. 2) giving the appearance of an oil droplet. The protrusion may be several millimeters in diameter. Hyaloid remnants have been observed to arise from the apex of the lenticonus, from its slope, or from its nasal rim, or more usually are absent all together.

The axial refraction is always markedly myopic and the periphery is often hyperopic. Visual acuity is reduced ordinarily 20/50 or less.

Posterior lenticonus is a rare anomaly and does not indicate enucleation. Our knowledge therefore of the pathology is limited to the details observable by slitlamp examination. Recently, we received for pathologic examination an eye which had been enucleated for retinoblastoma and was found to contain a posterior lenticonus. The case history and pathologic report follow.

Case report

G. L. a white male infant, was being followed closely by the staff of the Eye Clinic, Children's Hospital, Columbus, Ohio, because three siblings had previously died of retinoblastoma. At five months of age a small white mass was observed adjacent to the temporal side of the optic disc of the right eye. During the course of the examination a peculiar reflex and distortion was noted in the center of the lens. This was not well described because clinically this condition was incidental to the tumor mass at the optic disc. The left eye was entirely normal. The lens was clear and there was no evidence of any tumor in the fundus. The right eye was promptly removed and submitted for pathologic study.

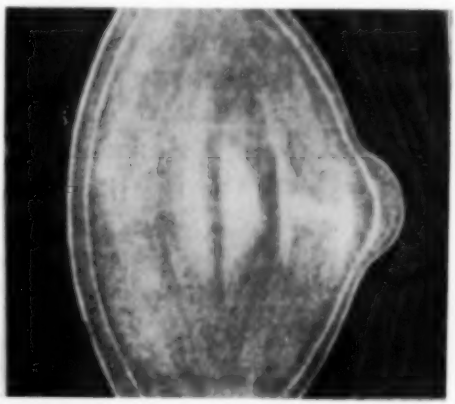

Fig. 1 (Makley). Optical section of posterior lenticonus. (Reprinted with permission from Butler.[3])

* From the Department of Ophthalmology, College of Medicine, The Ohio State University.

Fig. 2 (Makley). Posterior lenticonus as seen with the ophthalmoscope. (Reprinted with permission from Butler.[1])

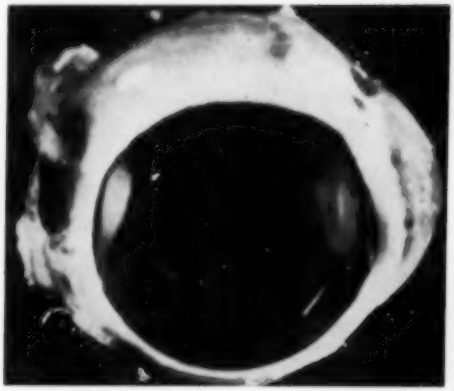

Fig. 3 (Makley). Posterior lenticonus. Gross specimen, showing the clear globular mass at the posterior pole of the lens.

PATHOLOGY REPORT

Gross examination. The specimen consists of a small firm eye measuring 21 by 21 by 20 mm. The cornea is clear and the pupil is well dilated. The eye is sectioned in the horizontal plane. The lens is interesting in that a 2.0-mm. ring surrounds a hemispheric projection of cortex at the posterior pole (fig. 3). As seen with the dissecting microscope this globular mass has the same clarity as the rest of the lens material.

Microscopic examination. The cornea is normal. The iris stroma is quite cellular, the cells of the anterior border layer being densely pigmented. The anterior surface of the lens is flat and there is a peculiar hemispheric bulge at the posterior pole (fig. 4).

A most striking feature is the presence of the lens epithelium just beneath the capsule in the area of the conus. This epithelium stops abruptly at the edge of the bulge. Over the apex it appears multilayered but appears single near the margins (fig. 5).

The deeper cells appear to be changing axis and sending out processes or forming globular cells analogous to the abortive lens fibers in a secondary cataract (fig. 6). The cortical material in the conus appears almost homogenous but faint thin parallel lines can be seen running through it with reduced illumination.

The lens capsule is very thin, almost absent over the apex of the cone, and on either side of the cone it is serrated. The lens cortex appears normal but posteriorly takes a backward direction toward the conus. The nuclear bow and equator look normal but there are many small vacuoles in the cortex just beneath the posterior capsule near the equator.

Arising from the retina adjacent to the

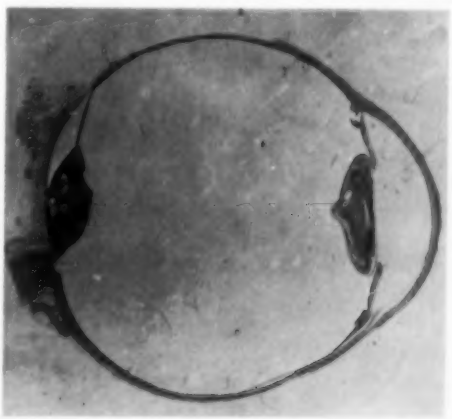

Fig. 4 (Makley). Microscopic section. Note the flatness of the anterior surface of the lens.

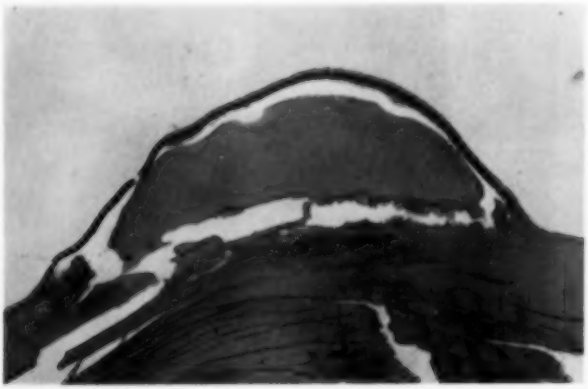

Fig. 5 (Makley). Microscopic section, low power. Lens epithelium is present beneath the capsule and sharply limits the lenticonus. Fine striations run through the cortical material filling the cone. The spaces and rupture of the lens fibers are artefact.

optic nerve is a mass, which extends subretinally, composed of small cells with round dark-staining nuclei. The cells arrange themselves around the blood vessels and many small rosettelike figures are present. There is no extension of the tumor into the optic nerve.

Diagnosis. Retinoblastoma; posterior lenticonus.

Discussion

Since posterior lenticonus is a rare anomaly, and most cases that have been reported were studied with the slitlamp, writers have been at a disadvantage in theorizing as to the cause. Two cases studied histologically have been in eyes with other gross developmental anomalies.[5] The following possibilities have been suggested.

There is weakness of the lens capsule allowing herniation of the lens substance. Vogt[16] thought this might be due to faulty development at the anterior end of the Cloquet's canal providing a niche for the reception of the lenticonus. But according to Salzmann[7] this central canal hits the lens nasal to the posterior pole.

Mann[6] feels that the lens must have developed normally until at least the fourth month therefore the deep layer of the capsule must have been normal. The superficial or zonular lamella form during and after the fourth month but does not reach the anterior or posterior pole and as soon as it is complete it begins to exert traction on the lens causing it to become biconvex. It might

Fig. 6 (Makley). Microscopic section, high power. The deeper cells of the lens epithelium appear to be changing axis. One cell has long slender processes as if it were becoming a lens fiber.

be postulated that abnormal stress and strain due to traction might cause abnormalities in curvature especially where the capsule has least support at the posterior pole.

Marsh[2] also suggested the theory of a lental hernia and feels that lenticonus posterior is not essentially a congenital or developmental anomaly, but may be the result of accommodative strain under unknown but favoring conditions in the highly plastic lens of a young child; that is, the force causing the hernia is accommodation.

Hyaloid remnants have been noted in some of the cases, attached near the posterior pole.[9] Vogt made the logical objection that traction would produce an angular protrusion rather than a smooth hemisphere and further that the hyaloid remnants were not strong enough to distort the lens. A primary overgrowth of the lens fibers might force out the posterior pole of the lens, thinning or bursting the capsule.[11] Very little evidence can be found to support this theory. Ida Mann states "it is difficult to get a picture of an overgrowth of fibers only manifest at their posterior end when their cells of origin are in the equatorial region." That this could happen in the case presented is evident.

How does this pathologic study help us in our thinking about posterior lenticonus?

First of all, the findings can only help us in theorizing what has happened here. The protrusion in this case is clear, globular, and uncomplicated by any other anomaly and rightfully, according to Berliner,[5] should be called a lentiglobus.

The most remarkable feature is the isolated remnants of the lens epithelium at the posterior pole. Its extent limits the lenticonus. This epithelium is arranged in a fairly typical single layer marginally but at the apex it becomes multilayered and the deeper cells have changed their axis and look like spindle cells suggesting early lens fibers. Persistence of this island of posterior epithelium would have to date from an early stage because by the seventh week the secondary lens fibers begin to form and normally there is no epithelium beneath the capsule posteriorly.

The lens material filling the conus is sharply demarcated from the remainder of the cortex, although it does curve backward toward the cone. This case would be a bit of evidence in favor of an overgrowth of the lens fibers (phakoma) causing the protrusion although there are pitfalls in this thinking.

Why do not some of the nuclei persist in the lens fibers filling the defect as they do at the equator?

Does the abnormal flattening of the anterior surface of this lens have anything to do with the posterior bulge?

The possibility also exists that the cells overlying the lenticonus are of mesodermal origin rather than persistent posterior lens epithelium. If so, this origin of these cells would have to date back to before the formation of the lens capsule at 13 mm. Finally, the lens was not studied with the slitlamp. It would have been interesting to know if there was any defect in the fetal nucleus due to lack of development of a portion of the primary lens fibers. This is not evident in sections.

Recently Franceschetti and Rickli[15] reported a case of posterior (eccentric) lenticonus. They were struck by epithelium beneath the lens capsule and the heterotopic nuclei in the region of the lenticonus and propose the hypothesis of an exaggerated apposition of the lens fibers in connection with an aberrant zone of growth. This report lends support to Pergens' idea of a primary overgrowth of lens fibers causing the lenticonus.

Summary

A case of posterior lenticonus uncomplicated by other anomalies in an infant five months old is presented. Histologic study revealed an heretofore unreported finding of subcapsular cellular elements overlying the lenticonus. Abnormal persistence of part of the posterior lens epithelium is suggested as

the origin of these cells. Deposition of mesodermal cells upon the lens prior to formation of the capsule at 13 mm. is an alternate possibility. Either mechanism would indicate that the aberration responsible for this case of posterior lenticonus began during the first six weeks of development. Various other theories of origin of lenticonus are discussed.

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MODERN APPROACH TO GLAUCOMA*

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Glaucoma stands out today as one of the most baffling diseases in ophthalmology. Because of the continued obscurity and disagreement regarding the underlying disturbances in physiology, treatment continues to be on an empirical basis. In this presentation, all the pertinent available papers of recent years, including the unpublished papers presented at the recent XVII International Congress of Ophthalmology (Montreal Session, September 10 and 11, 1954, and New York Session, September 12 to 17, 1954) and the 59th annual meeting of the American Academy of Ophthalmology and Otolaryngology (New York, September 19 to 24, 1954), have been reviewed and organized into the various categories under which the disease can be considered at the present time.

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Historical

Glaucoma is not a disease entity. It is rather a whole complex of diseases which have as their common feature an abnormal elevation of intraocular pressure with its dire consequences.

Although the word glaucoma appeared in the writings of Hippocrates[1] (460-370 B.C.), the association of the disease with a raised intraocular pressure is of a much later date. In the Hippocratic *Aphorisms* the term used to describe blindness coming on in advancing years referred mainly to the greenish or bluish pupil.

Some of the instances of blindness recorded in the *Old Testament* might well have been caused by glaucoma and I cite two here for their interest:

"Now Isaac was old, and his eyes were dim, and he could not see: . . ."[2]

"For Israel's eyes were dim by reason of his great age, and he could not see clearly."[3]

Originaly the term undoubtedly included absolute glaucoma which remained undifferentiated from cataract. It was only later recognized by Galen[4] (130-200 A.D.), Rufus of Ephesus[5] (fl. 115), and other writers of the early Christian centuries that the morbid conditions situated behind the pupil which gave rise to blindness could be differentiated into two groups, "suffusion" or cataracts which were amenable to operative treatment, and the glaucomas which were not.

In the centuries following the decline of the Roman Empire no new solution of the problem was advanced. Alexander of Tralles (525-605) and Paul of Aegina[6] (625-690) both differentiated between the blindness arising from glaucoma and that caused by other conditions. They were compilers of medical knowledge and in the dimming twilight of their period, they deserve credit for preserving the recorded findings of the authors preceding them. In this way Byzantine medicine preserved knowledge until the rise of Arabic medicine.

Though Antoine Maitre-Jan[7] (1650-1730) contended that both diseases resided in the lens, Brisseau[8] (1696-1743) disproved this conception. He located cataract in this tissue during repeated dissections of the cataractous lenses of dead soldiers, but disproved any lenticular abnormality in glaucoma by an anatomic examination of the eyes of Bourdelot, the blind physician of Louis XIV.

The first clear recognition of a separate morbid entity corresponding to our modern conception of glaucoma seems to have appeared in the writings of the Arabian Samsad-din[9] (fl. 1348), who described among the ophthalmias a "migraine of the eye" or "headache of the pupil," an ocular disorder characterized in its acute stage by hemicrania, deep-seated inflammation of the eye, and turbidity of the humors, followed occasionally by cataract and permanent dilation of the pupil. He stated that if the disease became chronic, tenseness of the eye and blindness supervened. This conviction was so far in advance of the times that it failed to attract attention.

Three centuries later Richard Banister[10] (d. 1626), an itinerant English oculist and author of the first formal book on ophthalmology in English, gave a description of a form of incurable cataract, gutta serena, which was analogous to absolute glaucoma. He clearly differentiated between curable cataract with its opaque pupil and gutta serena with its transparent pupil.

These observations seemed, however, to have passed unnoticed although they were quoted by Sir William Read,[11] the oculist to Queen Anne. Read extolled the good results he had obtained by performing a paracentesis on a patient with the malady. Although the fact of hardness was again described by Johann Zacharias Platner,[12] a German anatomist in 1738, the symptom-complex of acute glaucoma was not adequately recognized until the detailed clinical description of Beer[13] appeared in 1792. He, however, failed to stress the cardinal feature, raised tension.

And so during the latter half of the 17th century and the beginning of the 18th century glaucoma was looked upon as a form of amaurosis distinguished from other cases of blindness by definite signs. Antonio Scarpa (1748-1832), called the Father of Italian Ophthalmology, in 1801 wrote the first text on diseases of the eye in the Italian language. Under the caption "Amaurosis" he described a form of amaurosis which is typical in its symptoms of the later stages of primary glaucoma.[14]

While Mackenzie (1791-1868) cannot be credited for the discovery of hardness of the eyeball in glaucoma he did much toward establishing it as the essential feature of the disease in his classical textbook.[15] His claim to priority of treatment by paracentesis[16] must be questioned, for both Read[11] and Desmarres[17] had resorted to the same operation for the same purpose many years before.

In the United States, as late as 1846,

glaucoma was still looked upon by some writers as a form of amaurosis. Increased intraocular pressure was not regarded as the main symptom of the disease. They adhered to the old notion that the discoloration of the pupil was the main diagnostic feature of glaucoma.[18]

The next epoch in the history of glaucoma followed the introduction of the ophthalmoscope (Helmholtz,[19] 1821-1894), when clinical observations on the glaucomatous cup began to be recorded. Hypertension became universally admitted to be the essential cause of acute glaucoma and Mackenzie's contention was re-established as true. Donders[20] (1818-1889), made a final important clinical observation of this period—that of chronic simple glaucoma wherein an incapacitating increased tension occurred without any inflammatory symptoms. Thereafter interest was focused upon the etiology of the disease.

Classification

When we speak of normal intraocular pressure, we mean that pressure which is compatible with continued health and function of the eye. Since normal tension as well as damaging high tension will vary within wide limits from one eye to another, there is less ambiguity in saying that the "normative" pressure for a particular eye, that is, the pressure compatible with continued health and function of that eye, need not coincide with the average normal—a term better suited to a statistical definition. For example, there are some eyes that appear to suffer glaucomatous damage even though their pressure is at all times well within the average normal range.

At the present time the so-called *primary glaucomas* embrace two major and different types, in both of which the abnormal elevation of intraocular pressure occurs without other antecedent intraocular disease. In one, the chamber angle is of normal depth and configuration. In the other, the chamber angle is narrowed and becomes encroached upon by peripheral anterior synechias. To this second type the classic acute congestive glaucoma belongs. The mechanical school of thought embraces this classification whereas the neurovascular school seems more restricted in its approach to the disease in that it arbitrarily assumes a neurovascular origin for all types of primary glaucoma.

In speaking on the etiology and general concepts of primary glaucoma at the XVII International Congress of Ophthalmology, Vail[21] stated that many believe now that the acute congestive form is a distinct and separate disease entity occurring only in people who have congenitally narrow angles which become acutely blocked off by the iris base under special conditions, of which neurovascular influences play a large role. He entered a plea for the recognition of this entity, stating that if accepted it would go a long way toward clarifying the problem and allow us to concentrate our attention on the chronic simple form, about which so little is actually known.

Agarwal[22] (India) made similar recommendations during the XVII International Congress of Ophthalmology, when he concluded that the sympathetic and parasympathetic nervous systems play no role in the etiology of glaucoma. He feels that the pathogenesis of chronic congestive glaucoma and chronic simple glaucoma is the same and that their classification as separate entities therefore is unjustifiable; also, that although the pathogenesis of acute primary glaucoma is uncertain it is undoubtedly associated with a vascular crisis.

In addition to primary glaucoma, we have the *congenital glaucomas* which arise in infancy as a consequence of some developmental malformation of the eye. Glaucoma as a complication of some other disease or damage to the eye is classified as *secondary*.

Mechanism

Basic to any understanding of the pathogenesis of glaucoma is a knowledge of the mechanism of control of intraocular pressure, that is, of the mechanism by which

fluid and dissolved substances are transported into and out of the eye.

Leber's[23] (1840-1917) theory, which he advanced in 1903, that the aqueous humor is formed by slow filtration from the blood vessels of the ciliary body, and perhaps from the iris vessels, and is absorbed by way of Schlemm's canal, and is in a state of steady motion or flow, has been reaffirmed and agreed upon by several modern investigators following observations made upon diseased, experimental, and near normal eyes.[24-31]

The aqueous is now considered to be formed by a combination of secretion and diffusion through the blood-aqueous barrier. It flows forward into the anterior chamber and escapes from the eye by means of the complex of Schlemm's canal, collector channels, intrascleral venous plexus, and aqueous veins. Thus, interference with the formation of aqueous, or its flow forward from the posterior chamber through the pupil into and toward the angle of the anterior chamber where the main fluid exits are located, will alter the intraocular pressure.

The chapter on glaucoma by Prof. Herman Schmidt[32] in the *Graefe-Saemisch Handbuch der gesammten Augenheilkunde*, 1877, has a surprisingly modern aspect. While a larger amount of time and effort has been spent in this field of study than in any other in the domain of ophthalmology, it is depressing to realize that we have made so little progress in our understanding of this condition in the past 75 years.

The controversy has become an historic one between supporters of the *neurovascular school* and those of the *mechanical (retention) school* and continues unabated, although some of the differences seem in the process of being resolved. The intensified efforts of highly skilled workers in both experimental and clinical research in various parts of the world are stimulating new thinking and new approaches to the problem.

The cause of glaucoma as we can now view it seems to be the result of a combination of two factors: (1) The obstruction to the outflow of the intraocular fluid and (2) a disturbance of the intraocular and general circulation in close relationship with the neurologic control of these factors. The weight of present scientific evidence is on number one.

The Neurovacular School

The leading proponent of the neurovascular school of origin of glaucoma is Sir Stewart Duke-Elder.[33] The neurovascular concept is a quite hypothetic one based upon the diurnal variations of the intraocular pressure.

These variations are influenced by a regulating mechanism which tends to maintain the intraocular pressure at a physiologic level within a slight habitual rhythmic variation in spite of the numberless strains and stresses to which the individual is exposed in everyday life.

Duke-Elder compares this diurnal variation in tension with diurnal variations in temperature, sleep, and diuresis. It is believed that the exaggerated rhythm of the ocular tension seen in glaucoma is due to a lack of the local vascular control which normally keeps variations of tension within comparatively strict limits.

Several adherents to the neurovascular theory attempt to link some of their glaucoma cases with systemic vascular diseases.[34-38] Such correlations are difficult to evaluate since the incidence of glaucoma is highest after the age of 60 years, a time when the incidence of systemic vascular disease also increases. Many believe that disturbances in the parasympathetic nervous system,[37, 38] the sympathetic nervous system,[39] and the central nervous system[40-44] may be factors in glaucoma; others believe in hormonal factors.[45] Many more theories have been advanced, none of which are overwhelmingly convincing in light of our present knowledge of facts.

There are a number of articles written in support of the neurovascular, neurovegetative theory.[40, 46-51] In the last few years the most notable studies on this subject have

taken place at the Institute of Ophthalmology in London.[52, 53] These studies were reviewed by Duke-Elder[53d] in his recent Proctor Lecture at the University of California.

Friedenwald's[54] hypothesis of an active transfer of electrolytes into the eye by the ciliary body has been confirmed by Kinsey,[55] Kinsey and Palm,[56] and Langham,[57] who demonstrated that the composition of the posterior aqueous differs more widely from that of the plasma than does that of the anterior aqueous. A corollary of this concept is that inhibition of the enzyme, carbonic anhydrase, might be expected to decrease the rate of secretion and lower the intraocular pressure.

Reports of the use of the carbonic anhydrase inhibitor *Diamox* on the intraocular pressure and dynamics are just beginning to appear.[58–60] The mode of action of Diamox in lowering the intraocular pressure is not yet established. Becker[60] reports that the evidence is accumulating to indicate that this drug acts directly on the secretory mechanism and inhibits the inflow of aqueous humor.

The effects of Diamox administration have been most encouraging in the acute glaucomas, both primary and secondary. Its effect is additive to that of the conventional medical therapy in the treatment of the chronic and congenital glaucomas. There are no doubt both theoretic and practical objections to such therapy as well as undesirable side effects to be encountered.

The mechanical (retention) school

Gonioscopy

The mechanical (retention) theory of the origin of glaucoma had its inception in 1923, when Raeder[61] suggested a glaucoma classification based on the depth of the anterior chamber.

In 1938, Barkan[62] presented a classification based on the state of the angle of the anterior chamber as observed with the gonioscope, and only recently he offered three interesting case reports which he feels give further confirmatory evidence of the mechanical theory of the origin of glaucoma.[63] One was a case of secondary glaucoma, in which the tension caused by the anterior displacement of the lens by a fibrous cord was relieved by its severance. Normalization of pressure by goniotomy was obtained in two cases of glaucoma associated with nevus flammeus.

Sugar[64] has also emphasized the significance of varying types of obstruction of the angle of the anterior chamber with the introduction of the gonioscopic and chamber-angle depth observations.

The technique of gonioscopy has advanced considerably in recent years and has been largely responsible for the evolution of the mechanical theory of the origin of glaucoma and its increased acceptance in this country. Supporters of this theory feel that the iris root blocks the trabeculum before the elevation of intraocular pressure and vascular congestion occur. The neurovascular school believes that the iris-root block is secondary and that the tension and congestion occur first.

The accumulated evidence of many investigators through anatomic and gonioscopic studies in support of the mechanical theory led the symposium panel[65] on primary glaucoma at the 1948 meeting of the American Academy of Ophthalmology and Otolaryngology in which Vail, Friedenwald, Kronfeld, Scheie, Dunnington, and Chandler participated, to adopt unanimously the classification of primary glaucoma into narrow-angle and wide-angle types, as proposed by Raeder[61] in 1923.

Duke-Elder[53a, b, c, d] has taken issue with this gonioscopic classification. He believes instead that glaucoma should be divided into two categories, congestive and noncongestive. He feels that, fundamentally, congestive glaucoma is due to a vascular instability.

Regardless of all such factors as neurohumoral anomalies, upsets in the balance between the sympathetic and the parasympathetic nervous system and endocrine dyscrasias, physical or psychosomatic factors, such as those stemming from emotional upsets in-

volving the thalamus and hypothalamic region, and even the instances when congestive glaucoma follows certain inflammatory lesions of the eye, trauma to the eye, a subluxated lens, venous obstruction, and other disorders, Duke-Elder believes that the local pathologic condition is clear, consisting of capillary dilatation, increased permeability, stasis and local edema, and often increased intraocular pressure. Repeated vascular crises, he maintains, may increase numbers of peripheral anterior synechias, the depth of the angle, and the tension.

Duke-Elder explains the mechanism of chronic simple glaucoma as a vascular disturbance somewhat different from that which produces the acute type. He feels the mechanism is due to an instability of vascular control over the intraocular circulation, characterized by insufficient nutrition of the ocular tissues, and causing subsequent sclerosis and atrophy, rather than stasis and edema.

Tonography

Much support has been given to the mechanical theory of origin of glaucoma by Grant's[66] excellent work in tonography, particularly his observations in cases of narrow-angle glaucoma which confirm the concepts previously established by gonioscopy. Grant's tonographic studies on eyes with primary wide-angle glaucoma indicating an obstructive mechanism have now been accepted by at least some advocates of both the mechanical and the neurovascular school. Grant's work is being confirmed by others.[67–75]

The site and nature of the obstruction can only be speculated upon at present. The obstruction could be due to organic changes in the trabeculum, the canal of Schlemm, or the aqueous veins. It might also be explained on the basis of a neurovascular disturbance which impedes flow through the aqueous veins, as suggested by Thomassen and Bakken,[76] and Duke-Elder.

Perhaps this is the common meeting ground for the two schools of thought on the subject. Rosengren[77] differs with Duke-Elder[38b, c] in his interpretation of the relationship between a shallow chamber and the vascular congestion. His views more closely parallel those of Miller[53] of the Glaucoma Clinic of the Institute of Ophthalmology in London, who feels the skepticism as to the distinction between the two groups is fundamental and perhaps stems from the fact that in the late stages of either disease the clinical features are barely distinguishable. Rosengren points out that it is only at a late stage in simple glaucoma that a certain vasodilation appears.

Since the cause of the spontaneous changes in the intraocular pressure is not well understood, de Roetth,[78] working in the Glaucoma Clinic, Institute of Ophthalmology, London, undertook to correlate Grant's observations with the diurnal intraocular pressure changes in the hope that light might be shed on the mechanics of the aqueous humor dynamics. He found that the facility of aqueous outflow in chronic simple glaucoma is relatively constant and does not show diurnal changes but that as the disease advances it becomes slowly, gradually poorer. This would seem to speak against a functional or neurovascular mechanism as the causative or controlling factor in the drainage of the aqueous humor.

The observations of Grant in cases of narrow-angle glaucoma have offered strong support to the gonioscopic concepts that the underlying cause of the disease is the narrowing of the angle of the anterior chamber. There are probably several factors that may bring about angle crowding leading to closure of the angle and that may precipitate an acute attack of glaucoma.

A dilated pupil will permit the iris to come into contact with the trabecula. A neurovascular element following emotional upsets or minor trauma to the eye could cause an increase in the rate of flow of aqueous. This increase would create a physiologic iris bombé and a rise in tension due to resistance to aqueous flow from the posterior to the

anterior chamber. Haas and Scheie[79] reason that the site of resistance in such a case might be the area where the iris rests upon the lens, for which a simple peripheral iridectomy is the remedy. Chandler[80] agrees with this hypothesis.

Gonioscopic studies seem to indicate that the mechanism of obstruction to outflow is of an entirely different nature in narrow-angle glaucoma from that in wide-angle glaucoma, since in the former the obstruction to outflow is due to block of the angle by forward displacement of the root of the iris, whereas in the latter the obstruction is evidently in the angle structures themselves. Tonography now comes along to strengthen this conception. Thus, the classification of primary glaucoma in the narrow-angle and the wide-angle groups, as first suggested by Raeder,[81] and further elaborated by Barkan,[82, 83] Sugar,[84] and others,[85] is proved to be valid. The ghost of hypersecretion as a factor in glaucoma, therefore, is finally interred.

Perimetry, tonometry, and, to a less degree, measurements of visual acuity and careful scrutiny of the optic discs have long been the principal means for the diagnosis and management of glaucoma, and doubtless will continue to play the most important role. We must admit however that Grant's clinical measurement of aqueous outflow has furnished us with one of the most valuable tools for the study of glaucoma that has evolved in several decades. Tonography has proved itself of value clinically in the diagnosis of glaucoma and, when combined with provocative tests, it offers unique opportunities for early diagnosis. The evolution of medical and surgical therapy may be greatly aided by repeated tonographic tracings.[69a, 78, 81]

Aqueous veins

Greatly increasing interest is being shown in aqueous veins since their original description by Ascher[86] in 1941. Their detection has added not only further proof to the continuous circulation of the aqueous humor but also a new impetus to glaucoma research. Ascher[87] has recently reviewed the work on aqueous veins. He favors the mechanical (retention) theory of glaucoma.

Ascher describes aqueous veins as biomicroscopically visible pathways of blood-vessel appearance containing clear, colorless fluid or diluted blood, and intercalated, probably via Schlemm's canal, between intraocular fluid on one side and conjunctival and subconjunctival veins on the other.

Ascher[86] ventured to say 10 years ago that mechanical interference with fluid elimination through aqueous veins may raise the intraocular pressure. He has further based his assumption on the structural similarity of the aqueous veins and the histologically described connections between Schlemm's canal and the veins on the surface of the eye.[88]

Recent meticulous microanatomic studies[76, 86] seem to confirm this assumed anatomy and role of the aqueous veins, proving that the aqueous veins really do derive from the outlets of Schlemm's canal, either directly or through the intrascleral vascular meshwork.

Some physiologic and experimental proofs have added to this microanatomic confirmation. Both Ascher[87] and Huggert[88] have found that eye pressure has been increased by the wearing of refraction-correction contact lenses.

Phenomena observed in aqueous veins are being adopted by the proponents of both the neurovascular and the mechanical schools.

Diagnosis

General considerations

Ophthalmologists realize the importance of early diagnosis of glaucoma because effective treatment depends almost entirely upon the early recognition of the disease.

It is therefore of extreme importance to realize that the symptoms of early glaucoma are vague and so may easily pass unnoticed by both patient and physician. The general

practitioner perhaps is in the best strategic position to help in the control of blindness, particularly blindness from glaucoma, since he sees these patients earlier and more frequently than the ophthalmologist. Too often patients are referred to the ophthalmologist after considerable sight has been lost, too late.

The *general practitioner* should be suspicious of glaucoma whenever there is rapidly increasing presbyopia, headaches, fleeting obscurations of vision, occasional presence of halos, a family history of glaucoma, and a feeling of fullness in the eye which may appear on waking in the morning, after a stay in the dark (as in a movie), after emotional upsets or slight vasomotor upsets due to a warm bath, or the taking of coffee or other stimulants.

Possibly 75 percent of people having defective vision today consult optometrists, and instances of frequent change of glasses are apt to be found in this group. This is one group of patients with undiagnosed chronic glaucoma that the general practitioner can be helpful in diverting to the ophthalmologist for diagnosis and treatment.

Heredity

The importance of heridity in glaucoma has been brought out by many investigators. In certain families glaucoma occurs in more than one member. Relatives of glaucoma patients constitute a group in whom a high incidence of undiagnosed glaucoma is to be expected. In fact, the only way to be safe from glaucoma is to have an adequate examination for its presence by a competent ophthalmologist at periodic intervals after 40 years of age.

Biró[89a] found a heredity factor in 5.6 percent in the series (761) he reported in 1939 but in 1951 he found a heredity incidence of 12.8 percent in his series (125).[89b]

Posner and Schlossman[90] found that 51, or 13.7 percent, of 373 unselected cases from private practice showed familial tendencies.

Sorsby[91] states in his recent textbook on *Genetics in Ophthalmology* that the familial tendency runs about 20 percent in all types of primary glaucoma.

François, Deweer, and van den Berghe[92] reported a family history of glaucoma in 50 percent of a series of patients with chronic simple glaucoma.

Kellerman and Posner[93] have recently reported finding eight, or four percent, out of 192 relatives of patients with primary glaucoma to have the disease, and, in addition, 11 who had findings strongly suggesting its presence.

The general practitioner should never neglect to make the following tests:

1. Vision—use the Snellen visual acuity chart (easily obtainable from A. M. A. headquarters) at 20 feet.

2. Pupil—see whether it is dilated and reacts slowly as in glaucoma.

3. Optic nerve—examine it with the ophthalmoscope to see whether it is "cupped" and pale as in established glaucoma.

4. Tension—become adept in feeling the tension of the eyeballs when the patient looks down. Make routine tonometry a part of the physical examination in patients over 40 years of age.

5. Fields—inquire as to the patient's side vision.

The red eye

Important consideration should be given to the patient who so often comes to the general practitioner with a "red eye." The point which should be stressed is a very simple one, but surprisingly it is seldom mentioned. When most physicians see a "red eye" they think only of conjunctivitis or iritis.

Have the patient look at the ceiling, and shine a light in his eyes. If the pupils are fairly equal and react readily he is not in serious trouble. The patient with a "red eye" might easily have conjunctivitis, iritis, or glaucoma.

In conjunctivitis the pupil will appear normal in size and will compare favorably with the pupil of the fellow eye as to size and reaction to light. In iritis the pupil will be reduced in size and will not compare favorably with the pupil of the fellow eye as to size and reaction to light. In glaucoma the pupil is usually dilated and will not compare favorably with that of the fellow eye as to size and reaction to light. In other words, if you find the pupils are not equal the patient is probably headed for trouble.

Another important point that should be brought out in connection with the handling of a "red eye" is that, if you feel you are confronted with a case of iritis, do not take the responsibility of instilling atropine into the eye. Atropine might inadvertently be instilled into an eye with glaucoma, and so produce disastrous results. Nor should a general practitioner be guilty of instilling atropine into a patient's eye following the removal of a topical foreign body and thereby disable the individual for as much as a week. Atropine for use in the eyes should remain the province of the ophthalmologist. It would be well if the atropine solutions and ointments in all general hospitals were to be locked up with the narcotics.

Education—through national organizations, glaucoma clinics, and so forth

Much has been done in the past and is continuing to be done by way of education through the National Society for the Prevention of Blindness, American Foundation for the Blind, and similar organizations.

One of the important developments in this country during recent years, of aid in both diagnosis and treatment, is the setting up of *Glaucoma Clinics* in the eye departments of many of our medical schools, and still others in cities where medical schools do not exist. The influence of such a program is being evidenced by the establishment of more such clinics not only here but in foreign countries. MacIndoe and Shortridge[94] mention the establishment of such clinics in Sydney, Australia, and Hobart, Tasmania. Alvaro and de Toledo[95] also point out the effectiveness of the glaucoma clinics which are being established in Brazil. Pichette and Audet[96] discuss the advantages of glaucoma clinics already established in Canada and state that the number is being constantly increased.

Tonometry

A most important phase of any glaucoma program is the alerting of practitioners in all branches of medicine to the signs suggestive of the disease. The participation of the general practitioner in glaucoma surveys by the measurement of ocular tension has been stressed by Pavia,[97] Berens and Tolman,[98] and many others. Zeller and Christensen[99] have only recently pointed out that routine tonometry must became a part of every physical examination.

Although the diagnosis of glaucoma does not depend solely on tonometric measurements, there can be no doubt that the reliability of such measurements is of major importance both in the diagnosis of borderline cases and in the evaluation of therapeutic procedures.

When the facts are faced, we find that 20,000 persons (15 percent of the blind population) in this country are totally blind from glaucoma, and that an additional 150,000 are blind in one eye.[100] But of far greater concern are the estimated one million persons (approximately two percent of persons over 40 years of age) in the United States who have chronic glaucoma but do not know it.[98]

Fralick,[101] in his introductory remarks opening a recent symposium on secondary glaucoma, stated that each year as medical science stretches man's life span, glaucoma becomes a more serious problem because it usually strikes older-age groups and is thus finding more and more victims.

The responsibility for the diagnosis of this latter group cannot be left to the eye specialist. I am in full accord with the recom-

mendation of Zeller and Christensen[99] that routine tonometry must become a part of every physical examination.

The concept of what constitutes a complete physical examination must be revised throughout the entire medical educational system and made to include tonometry before the one million undiagnosed glaucomas can be detected and patients prevented from acquiring irreparable visual disability.

A physician's concept of what constitutes a complete physical examination becomes fairly rigidly fixed in his mind during medical school and internship days. Serologic examinations for syphilis and survey chest films are nearly routine for every hospital and clinic admission. Do these young medical students and interns stop to realize that several hundred chest films are apt to be taken before a single active case of tuberculosis is detected, or that hundreds of blood samples have to be examined before one positive test is found! The unknown cases of tuberculosis or syphilis cannot begin to compare with the undiagnosed cases of glaucoma in the population over the age of 40 years.

The incidence of unrecognized glaucoma far exceeds that of unknown cases of tuberculosis and syphilis. Despite the fact that interns not particularly interested in ophthalmology were easily taught to do tonometry, Zeller and Christensen[99] found that they were not impressed. They rightfully concluded that this attitude must be uprooted at its source, namely in our medical schools where tonometry should be taught.

Tonometry should be included in all courses in physical diagnosis and demanded by members of medical school faculties other than those of the eye department. No member of a medical school faculty can justifiably neglect to stress the importance of diseases that destroy the organ of vision any more than neglect to stress the importance of diseases that destroy any other bodily organ. This apathy probably reflects the general interest among medical school faculties other than ophthalmologists. It shows the need for arousing the profession as a whole to the importance of early detection of glaucoma.

The belief that to diagnose such a disease as early glaucoma requires special delicate equipment and training must also be dispelled. Posner[102] has reviewed the recent developments in tonometry and discusses the new Berens-Tolman[98] ocular hypertension indicator, an ingeniously designed and simplified version of the Schiøtz tonometer. Its inexpensiveness, rugged construction, and simplicity of operation should assure its widespread use and popularity.

Perimetry

No ocular disease is more intimately associated with perimetry than glaucoma. Traquair[103] states that it is largely to the investigation of the field of vision in this disease that perimetry itself owes its development. Our clinical knowledge of glaucoma has been greatly advanced in recent years by perimetric studies. Perimetry is not only of extreme importance in the diagnosis of glaucoma but is also a very useful method of following the clinical course of the disease. It aids somewhat also in the prognosis, a point emphasized by Posner and Schlossman.[104]

Provocative tests

It cannot be stated too strongly that in the early diagnosis of primary glaucoma the finding of a normal, or even subnormal, tension on one or even more occasions is no proof that glaucoma does not exist. In suspected and doubtful cases the diurnal variation in tension is usually investigated by the ophthalmologist over a period of two to three days. According to Duke-Elder[105] a variation of 10 mm. Schiøtz indicates latent glaucoma, even though the tension never rises above accepted normal limits.

Supplementing tonometry studies such as this, or if they cannot be undertaken, certain *provocative* tests are available by which an abnormal rise of tension may be excited. The object of provocative tests is to elicit any instability in the ocular tension, for the

normal eye has the capacity to maintain its pressure in equilibrium despite considerable provocation, an adaptability which the glaucomatous eye has lost.

Many provocative tests have been advocated since the dark-room test of Seidel,[106] and the search continues for more accurate and reliable ones. Since, however, none of them is universally applicable or absolutely reliable, it is always advisable to apply more than one.

It is to be remembered that these tests, while fairly conclusive if positive, mean nothing if negative, for they do not occur universally, nor is there a uniform response with the same patient at different times. The value of provocative tests lies in the evidence they bear in conjunction with other factors.

Medical treatment of glaucoma

Since the rational treatment of any disease or disorder is directed primarily against its cause and secondarily against its symptoms, the treatment of primary glaucoma must still be considered most unsatisfactory. While we have progressed far beyond the state of affairs obtaining before the introduction of iridectomy by von Graefe[107] in 1857, when a diagnosis of glaucoma was tantamount to a sentence of blindness, we still have a long journey to travel.

In speaking on the medical treatment of primary glaucoma before the New York Session of the XVII International Congress of Ophthalmology (September 12 to 17, 1954) Rudolf Thiel[108] said that, since the pathogenesis of primary glaucoma is not yet fully understood, there is no specific but only a symptomatic therapy.

The aim of all methods of treatment is the relief of increased intraocular pressure. The eye, Thiel stated, is only one component of a functional circle that has to do with the regulation of its inner pressure. The remainder of this functional circle consists of superimposed centers situated in the diencephalon. The autonomic nervous system and the endocrine system form the connecting link through which neuro-reflex and hormonal stimuli are transmitted to the center and vice versa. Thiel believes that primary glaucoma is the result of a disturbance of this functional circle, and that its medical treatment may be directed at any one of the three main components of the functional circle (eye, diencephalon, neurohormonal transmission).

There is the necessity, therefore, of a division into a local and a systemic therapy. Thiel feels that local therapy is still of prime importance. His paper covered the general fundamental questions of medical treatment and the indications for discontinuation of medical treatment.

Thiel further emphasized a vascular component besides mechanical factors that take part in the pathogenesis of glaucomatous optic-nerve atrophy. He felt, therefore, that treatment with vasodilators (nicotinic acid, priscoline) seemed promising and should be tried after the surgical correction of increased intraocular pressure.

In 1950, Adler,[109] who is an adherent to the mechanical (retention) concepts, recommended a thorough trial of miotics for wide-angle glaucoma, whereas he urged early operation for patients with the narrow-angle type. In the same year, McGuire[110] reviewed the treatment of glaucoma from the standpoint of the general practitioner.

During the past year Swan[111] presented in a most analytic and informative fashion the rationale for the proper use of miotics in chronic glaucoma. He classified the various drugs, discussed their mode of action, and recorded his experiences with them.

One startling advance has been made in the medical treatment of glaucoma during the past year. Reports of the decrease in intraocular pressure in man by the use of the carbonic anhydrase inhibitor, *Diamox*, are just beginning to appear.[58-60] The effects of the administration of this drug has been most encouraging in the acute glaucomas, both primary and secondary. The cautious use of it is still to be urged so as to accumulate more rapidly a large clinical experience with the

drug. For the present at least its effect should be regarded as additive to that of the conventional medical therapy in the treatment of the chronic and congenital glaucomas. There are no doubt both theoretic and practical objections to its use, as well as undesirable side effects to be encountered.

Surgical Treatment of Glaucoma

The surgical treatment of primary glaucoma must be undertaken every time the medicinal therapy, local and general, does not suffice to prevent deterioration of visual function. Often the duration of medical treatment must be shortened on account of the advanced stage of the disease when the patient is first seen, also because of the irreversibility of glaucomatous damage.

Surgical treatment is instituted to combat only the hypertension. This state of affairs will remain until our ideas of the etiology of glaucoma are more fully clarified. Until then no criteria for choice of surgical procedure can be advanced that will ideally suit the type of glaucoma present in each particular case and the stage it has reached. We must be more certain than we are now that what we elect to do will preserve the function of the eye, maintain its tension within normal limits, and retain the integrity of the globe.

The classical basal iridectomy of von Graefe[107] (1828-1870) which he introduced in 1857 has survived to the present day almost without change, and remains the operation of choice with most surgeons in acute congestive glaucoma.

Chandler[80] accepts the classification of primary glaucoma into narrow-angle and wide-angle types based on gonioscopy, clinical measurements of aqueous outflow (tonography), and various other clinical observations. In a most comprehensive article on narrow-angle glaucoma Chandler[80] advises peripheral iridectomy or iridotomy early in its course. For the neglected cases in which the disease is unresponsive to miotic treatment, he recommends iridencleisis or a modified iridectomy which he has devised.

Haas and Scheie[79] also report good results from peripheral iridectomy and advocate its early use in the course of the disease. Beckett,[112] Posner,[113] and Goldberg[114] also favor iridectomy for acute glaucoma.

Sourdille[115] spoke on the surgical treatment of primary glaucoma at the recent New York Session of the XVII International Congress of Ophthalmology. He prefers the clinical classification of the disease as adopted by the glaucoma symposium panel of the American Academy of Ophthalmology and Otolaryngology in 1948.[65] He says the classification is simple, and that since it conforms to the application of precise surgical rules it is more useful to the surgeon.

Sourdille's report of his results in 800 operated cases of chronic glaucoma clearly gave the advantage to iridencleisis. When he employed iridencleisis, 91 percent of his functional and 84 percent of his visual results were good. When he followed Lagrange's procedure,[116] 85 percent of his functional and 64 per cent of his visual results were good. When he followed Elliot's procedure,[117] 82 percent and 63 percent were good. He presented statistics of operative results from several countries since 1930 and reached the general conclusion that surgical treatment was undoubtedly efficient.

Fistulizing procedures (iridencleisis), corneoscleral trephination (Elliot's operation), and anterior sclerectomy (Lagrange's operation) in this order continue to be the most widely done operations for chronic simple glaucoma. Most observers feel that all these procedures function by means of fistulization, the tension being normalized through the creation of a new drainage channel for intraocular fluid.[118-121] There are a few observers, however, who feel that the success in fistulizing operations is due not to mechanical fistulization but, more probably, to trauma of the uveal tract and readjustment of the neurovascular system.[122, 123]

McNair,[124] on the basis of replies to a questionnaire, states that filtering operations are not too successful in Negroes and that

cyclodiathermy is finding increasing favor with these patients.

Cyclodiathermy was first introduced by Vogt[125] in 1936, and as judged by the number of articles on the procedure that have appeared in the literature the past two years its revival seems justified. Because of a decided tendency to move the site of the diathermy applications more posteriorly (seven to nine mm.) from the limbus, the procedure is more correctly referred to as *retrociliary diathermy*.[126–128]

Weekers and Weekers[129] state that cyclodiathermy performed according to their technique is most useful in congenital glaucoma. Barkan[130] calls attention to the popularity of cyclodiathermy on the continent of Europe as a primary procedure for all stages of congenital glaucoma. In his series of cases Barkan employed it only when goniotomy failed.

Congenital glaucoma

The term "congenital glaucoma" applies to those cases of increased intraocular pressure which arise in infancy as a consequence of some developmental malformation of the eye. Both an infantile and juvenile type continue to be recognized; the infantile type occurring in children up to three years of age and the juvenile type occurring in older children and young adults.[131]

There is no doubt that true, primary infantile glaucoma is caused by anomalies of ocular development in the fetal period. Shaffer[131] points out that the microscopic anatomy of infantile glaucoma shows no abnormal mesodermal reticulum; that there is a high insertion of the iris on the trabeculum; and that Schlemm's canal is not always perfectly formed. He concludes that the etiology of infantile glaucoma is therefore due in part to the anomalous insertion of iris into the most permeable part of the trabeculum, and in part to some impermeability of the trabeculum itself. In an occasional case Schlemm's canal may be too faulty for goniotomy to be successful. Shaffer[131] also points out that agents other than defective genes might be responsible, such as an illness of the mother. In general, however, the evidence indicates its inheritance as an autosomal recessive characteristic, according to Falls and Franceschetti.[132] There is still considerable room for debate upon the exact role played by the anomalies described in connection with infantile glaucoma. A great deal of work needs to be done before the pathogenesis of infantile glaucoma can be said to be established.

Primary juvenile glaucoma occurs at such an early age that both congenital predisposition and congenital anomaly must play a part. There seems to be no basis upon which to differentiate juvenile glaucoma from chronic simple glaucoma of adults except the arbitrarily set age limit of 30 to 35 years of age.[133, 134]

A plea for the early diagnosis of infantile glaucoma is stressed by both Barkan[130] and Scheie[135] because of the favorable response to surgery if operated before the eye is badly damaged by the disease. Photophobia, blepharospasm, and epiphora constitute the earliest symptoms of the disease.[134, 135]

This is true regardless of haziness of the cornea, corneal diameter, or other clinical signs. In Scheie's[135] experience photophobia is usually the first manifestation of the disease and whenever it occurs in a child under one year of age it should immediately suggest the possible diagnosis of infantile glaucoma. Examination and recording of tension under deep surgical general anesthesia, preferably with endotracheal intubation, is stressed by both Barkan[130] and Scheie.[135]

The treatment of infantile glaucoma is primarily surgical. Deferment of surgery by the use of medical therapy was strongly condemned by the panel members of a recent symposium on congenital glaucoma.[136] They also felt that goniotomy was the operation of choice, an operation which has been popularized as a result of the outstanding work of Barkan.[130, 137] Goniopuncture, a filtering operation developed by Scheie[135, 138] as a result

of observations following goniotomy, either alone or in combination with goniotomy, also shows some promise in the treatment of congenital glaucoma.

Both Barkan[139] and Scheie[135] point out that if either of their procedures are unsuccessful, other operations can be done without disadvantage. Operations such as corneoscleral trephination, iridencleisis, cyclodialysis, and cyclodiathermy should be reserved for secondary operations after goniotomy or goniopuncture have failed.

The approach to the angle across the anterior chamber was first introduced by de Vincentiis[139] in 1891-1893, and some successes were reported. The method later fell into disuse. In 1936 Barkan[137a, b] devised his modification of de Vincentiis' incision of the iridic angle which he termed goniotomy. He reports success in over 80 percent of 210 eyes with congenital glaucoma operated upon by goniotomy.[139] Barkan has recently described the technique of goniotomy in considerable detail.[139, 137g, h] Because of Barkan's work, de Vincentiis[140] has suggested calling the operation de Vincentiis-Barkan operation.

Before performing the operation Barkan removes or denudes the clouded epithelium with a keratome making it possible to operate under gonioscopic control in most cases. If cloudiness is so marked that visualization of the angle is not possible after removal of the clouded epithelium, good results, he claims, may still be obtained by operating without visualization. Barkan[139] feels that the carbonic anhydrase inhibitor, Diamox, may be employed to reduce the pressure and clear the cloudy cornea before operation and that it may also prove of value in the interim period between operations. The preoperative use of Diamox should not be allowed to delay operation.

Secondary glaucoma

In secondary glaucoma the symptom of raised pressure occurs as a complication of some other known disease or damage to the eye. The mechanism of secondary glaucoma is fairly well understood. There is little denial that both neurovascular and mechanical factors enter into its production, either separately or together, in the same eye.

The etiologic conditions are many and various. The published papers of a recent symposium on secondary glaucoma (1950) in which Fralick, Rychener, Clark, Knighton, and Sugar participated deal largely with therapy, and to a less extent with etiology.[141]

Glaucoma secondary to intraocular inflammations (uveitis) is the commonest type of secondary glaucoma. It is quite generally agreed that surgical intervention should be delayed as long as possible in glaucoma secondary to uveitis, and that treatment should be directed at the underlying uveitis.[142-145]

A rise of tension following trauma to the eye may occur shortly after contusions whether they be uncomplicated or involve gross intraocular lesions, or may develop a considerable time after a perforating injury, either traumatic or operative, healing of which is complicated by the incarceration or ingrowth of tissue.

The prognosis in traumatic glaucoma depends largely upon the seriousness of the associated lesions. In uncomplicated cases the hypertension usually returns to normal in the course of a few days; but if serious intraocular lesions are present the outlook is more doubtful. The treatment of posttraumatic glaucoma is often surgical, but to be successful a thorough understanding of the conditions present must be had so that the surgical procedure can be properly directed.

Glaucoma secondary to changes in the lens may be due to congenital deformity of the lens (microphakia); congenital or traumatic subluxation of the lens; intumescence of the lens; a morgagnian cataract or senile exfoliation of the lens capsule (glaucoma capsulare). Rychener[146] discusses most of these conditions in an excellent review on glaucoma of lenticular origin.

Thrombosis of the central retinal vein leads to one of the most hopeless types of secondary glaucoma (hemorrhagic glau-

coma). The excellent and concise review on the subject by Mancall[147] in 1951 is particularly important in view of the widespread use of anticoagulant therapy in these cases.

Mancall concludes that the nature of the occlusion is not always the same. The strikingly better results obtained in the younger-age groups from anticoagulant therapy he feels are presumably due to canalization of true thrombi; whereas, in the elderly patient, the rationale for the use of anticoagulants is not valid, since the occlusion in these instances may be due to endothelial and subendothelial proliferation, with closure due to contraction of the new-formed connective tissue and endothelial proliferation into the lumen of the vein.

Intraocular tumors may give rise to secondary glaucoma. It has now been established that the factors responsible are not those of size and volume, but rather those of site.[148] Enucleation of the globe is the undisputed treatment of any intraocular tumor, and the only advisable treatment to adopt in all cases of blind painful eyes with raised tension in view of the likelihood of their containing a neoplasm.

The foregoing are in the main the most common conditions with which a secondary glaucoma can be associated. Needless to say there are other unusual and rare situations in which this dreaded complication may arise.

Conclusions

The pathogenesis and classification of the complex of diseases which we refer to as "glaucoma" continue obscure and in dispute. Consequently, treatment, both medical and surgical, is essentially empirical. The success of treatment depends primarily upon its institution before irreparable impairment of vision has occurred.

The symptoms of early glaucoma are vague and often overlooked by both patient and physician. To expedite diagnosis and bring more of these patients to the attention of the ophthalmologist before it is too late, tonometry should be made an essential part of every general physical examination; it should be taught in all medical schools and practiced by the general physician. The results would be rewarding, for the incidence of undiagnosed glaucoma in those over 40 years of age is estimated at one million persons in this country alone.

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MULTIPLE STRESSES, INTRAOCULAR PRESSURE, AND ACUTE GLAUCOMA*

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It is generally accepted that a number of different stimuli and conditions may either increase or decrease intraocular pressure. Some of these stimuli were described in previous articles. Odors of a substance such as benzene decreased intraocular pressure in rabbits, whereas l-citronellol increased it.[1] Exposure of rabbits to light, injection of spinal fluid from light-exposed rabbits, and faradic stimulation of the ciliary ganglion raised the tension.[2] Exposure to dark, injection of spinal fluid from dark-exposed rabbits, and faradic stimulation of the superior cervical ganglion lowered the tension.[2] The effects of several other materials were determined and are recorded in this presentation (table 1).

Since exposure to multiple and various stimuli in the environment is not uncommon, it was decided to administer stimuli successively and to evaluate the effects on intraocular pressure. The experience of Berens and his co-workers[3] in treating allergic patients with glaucoma are perhaps pertinent to this subject. Berens found it necessary to summate two distinct forms of treatment to achieve control of the disease. In order to treat glaucoma successfully, he used miotics as well as an allergen-free diet.

Our studies were performed on rabbits. The animals were handled repeatedly by the same investigator before the experiments were started. Ocular tension was obtained by the Schiøtz tonometer. The recorded readings were in terms of the third corrected curve of Schiøtz. The eyes were anesthetized with one to two drops of one-percent butyn given two or three times. Tension was obtained with the 7.5-gm. weight.

The animals were exposed to one or more of the several stimuli which were found to raise intraocular pressure (table 2). Some of the rabbits were subjected to all the stimuli in succession. Each stimulus was applied for periods of 15 to 30 minutes. The animals were exposed to light, to the odor of l-citronellol, distilled water was instilled into the eyes, and hyperpiesin was injected intravenously. Exposure to light consisted of four hours of broad daylight with the addition of a 300-watt bulb placed 50 cm. from the cage.[4] The animals were subjected to the odor of l-citronellol for a period of 15 minutes. Distilled water was instilled into the eyes every few minutes until 12 to 15 drops were given. Spinal fluid in one cc. or larger doses, and prepared to contain hyperpiesin, was injected into the vein.

RESULTS

Determinations of ocular tension were made after each stimulus was applied to the animals. Exposure to light raised the tension from 2.0 to 5.0 mm. Hg. When the animals were then exposed to the odor of l-citronellol there occurred an additional increase of 2.0 to 4.0 mm. Subsequent injections of hyperpiesin produced a further elevation of 1.0 to 5.0 mm. Instillation of distilled water raised the tension by 5.0 to 6.0 mm. Hg. Each succeeding stimulus as it was applied to the animal resulted in adding to the intraocular pressure. The summation of all stimuli produced an increase in tension of 14 to 15 mm. Hg (fig. 1).

When the tension became elevated by 10 or more mm. Hg certain abnormal changes appeared. In order to ascertain whether

* From the Toledo Hospital Institute of Medical Research. This work was supported by a grant from the Walter Snyder Ophthalmic Foundation.

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TABLE 1

EFFECT OF VARIOUS SUBSTANCES AND CONDITIONS OF INTRAOCULAR PRESSURE OF RABBITS

Increase Tension	Decrease Tension	No Change
Exposure to light	Exposure to dark	Injection of: (a) blood (b) aqueous humor (c) urine (d) saline extracts of retina, muscle, lung
Injection of spinal fluid of: (a) rabbits exposed to light (b) man exposed to dark	Injection of spinal fluid of: (a) rabbits exposed to dark (b) man exposed to light	
Injection of: (a) extract of anterior pituitary (b) extract of posterior pituitary of rabbit exposed to light	Injection of: (a) extract of rabbit posterior pituitary exposed to dark	
Injection of: (a) $CaCl_2$ (b) testicular extract into females (c) adrenaline, subcutaneously (d) atropine, subcutaneously (e) distilled water, by mouth	Injection of: (a) testicular extract into males (b) ovarian thyroid and liver extracts (c) acetylcholine and ergotamine, subcutaneously Hypertonic salt solution by mouth	
Exposure to odor of l-citronellol	Exposure to odor of benzene	
Electric stimulation of: (a) oculomotor nerve (b) central vagus (c) optic nerve	Electric stimulation of: (a) superior cervical ganglion	
Instillation into the eye of: (a) distilled water (b) paredrine, pericorneally	Cauterization of the ciliary ganglion Introduction into eye of paredine intraocularly Convulsions	

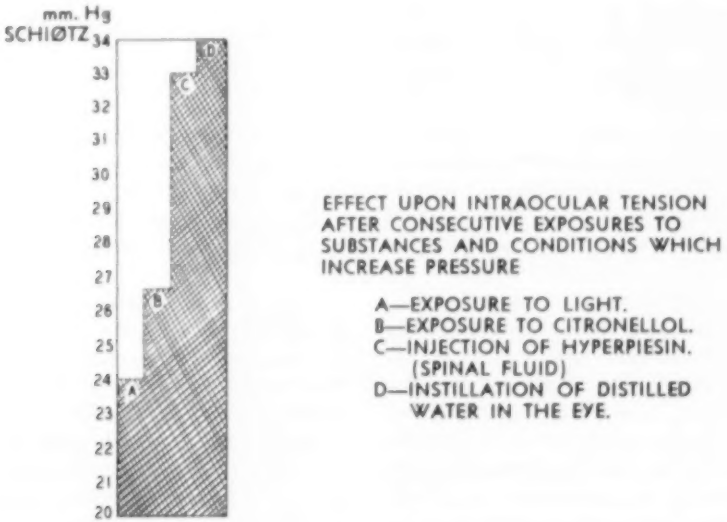

Fig. 1 (Schmerl and Steinberg). Rabbits were exposed to four stimuli, each one producing a slight increase of intraocular pressure. The successive applications of all the stimuli resulted in a summation of the effects. The intraocular pressure was raised to a considerable degree following the exposure of the animals to all the stimuli.

TABLE 2

EXPOSURE OF RABBITS SEQUENTIALLY TO SEVERAL STIMULI, EACH OF WHICH INCREASES INTRAOCULAR PRESSURE

(Tension measured in mm. Hg (Schiøtz)

Number of Rabbit and Eye Measured	Increase in Tension After Exposure to:				Increase All Stimuli	Pathologic Changes
	Light	Left-Citronellol	Hyperpiesin	Instillation of Distilled Water		
1. Right	4	—	—	—	4	None
Left	3	—	—	—	3	None
2. Right	4	3	—	—	7	None
Left	3	—	—	—	3	None
3. Right	2	4	—	—	6	None
Left	3	2	—	—	5	None
4. Right	2	3	—	—	5	None
Left	2	3	—	—	5	None
5. Right	4	2	3	—	9	None
Left	3	3	4	—	10	None
6. Right	3	3	—	—	6	None
Left	3	3	3	—	9	None
7. Right	5	3	5	—	13	Anterior chamber cloudy, iris hyperemic
Left	5	3	5	—	13	
8. Right	4	3	5	—	12	Anterior chamber cloudy, iris hyperemic
Left	4	2	4	—	10	
9. Right	4	4	1	6	15	Anterior chamber cloudy, iris hyperemic
Left	3	3	3	5	14	

The numbers in the columns represent increases in tension produced by the condition or substance heading the column. Dashes indicate no exposure to the substance.

Interpretation: Successive exposures to certain stimuli produce a summation of all increases in tension. When the increase in tension reaches a critical rise, manifestations of acute glaucoma appear.

these abnormal changes were produced by virtue of a multiplicity of stimuli or because of a "critical level" of hypertension, animals were subjected to an appropriate single stimulus. Large quantities of hyperpiesin in spinal fluid were injected intravenously. Because of quantitative variations of hyperpiesin in the spinal fluid and varying responses of the animals, accurate standardization was not possible. However, for purposes of clarity, each cc. of spinal fluid was considered a unit of hyperpiesin. Upon injection of four to five units of hyperpiesin with a resultant increase in tension of 10 to 17.5 mm. Hg, abnormal ocular changes were found. These abnormalities were similar to those observed upon exposure to several stimuli (fig. 2).

The hypertension lasted for periods of two to four hours following exposure to the last stimulus. Shortly after the intraocular pressure was increased by 10 mm. Hg or more, certain changes became apparent:

There was a decrease in transparency and a shallowness of the anterior chamber. The iris became hyperemic. Edema of the corneoscleral limbus made its appearance. A slight pupillary contraction and an absence of reaction to light were noted in the animals. These changes suggest a similarity to an acute glaucoma in man. One manifestation observed in the rabbits varied from that found in man. The pupils contracted in the animal while the reverse is true in man (table 3).

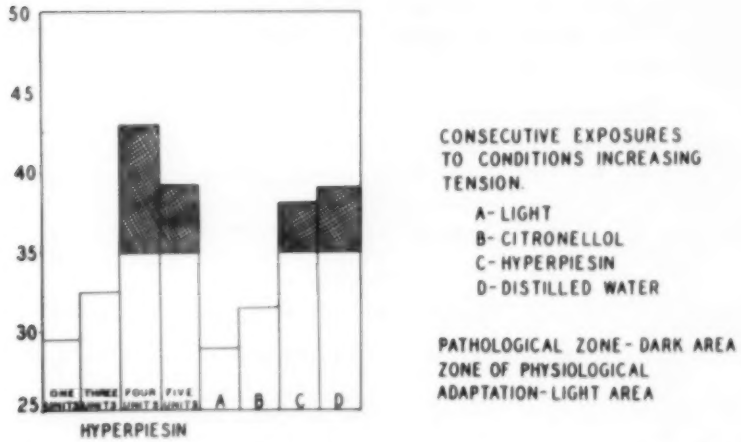

Fig. 2 (Schmerl and Steinberg). Rabbits were exposed successively to four different stimuli with a resultant summation of effects which raised the intraocular pressure by 10 mm. Hg or more. When this "critical point" was reached, manifestations appeared which were consistent with acute glaucoma.

Animals were exposed to a single stimulus (hyperpiesin) of sufficient magnitude to produce a "critical point." Changes consistent with acute glaucoma made their appearance. It was apparent that either a single or multiple and different stimuli, when producing a sufficient degree of ocular hypertension, resulted in symptoms consistent with acute glaucoma.

Hyperpiesin, a pituitary hormone, when introduced in sufficient quantities, produced an ocular hypertension which was of sufficient degree to result in symptoms consistent with acute glaucoma.

Discussion

The phenomena of "summation of stimuli" are well known in certain physiologic conditions. If one stimulus to voluntary muscle follows another at definite intervals, a summated contraction takes place. The contraction is greater in amplitude than that produced by one stimulus. The "staircase phenomenon" of cardiac muscle subjected to multiple successive stimuli is another example of summation. A disease entity may well be the result of multiple etiologic factors, one of which may be insufficient to produce the disease. In relation to acute glaucoma, one of several conditions alone, such as endophlebitis, thrombosis of retinal and choroidal vessels, may not be responsible for the onset of the disease but when combined with tenonitis, trauma, inflammation, hematoma, or other unknown states, glaucoma may make its appearance.

TABLE 3

Pathologic changes in eyes of rabbits following increase of intraocular pressure of 10 or more mm. Hg (Schiøtz)

1. Hyperemia of the iris
2. Edema of the corneo-scleral limbus
3. Clouding of the anterior chamber
4. Slight pupillary contraction
5. Shallowness of the anterior chamber
6. Absence of reaction to light

Interpretation: The changes observed in the eyes of rabbits with an increase of tension of over 10 mm. Hg (Schiøtz) are consistent with those in the (acute) congestive phase of glaucoma in man except for pupillary contraction.

In the experiments reported in this communication, the stimuli were within the physiologic range. No single stimulus was of sufficient magnitude to produce a critical increase of intraocular pressure. The purposes of the experiment were to evaluate the effect upon tension of different stimuli given successively but achieving a summation. Would a summation of stimuli produce a cumulative effect upon tension? Would it be possible to effect a "critical tension" which would result in abnormal changes in the eye? Would these

abnormal changes have any relationship to acute glaucoma? These experiments supplied affirmative answers to these questions.

Summary

A number of different stimuli were applied successively to the rabbit. Individually, each stimulus increased intraocular pressure by 2.0 to 6.0 mm. Hg. Upon application of several stimuli successively, a considerable increase of tension took place. This increase in tension represented a summation of effects of all the stimuli.

When the intraocular pressure reached a critical point, which was 10 mm. Hg for the rabbit, manifestations consistent with acute glaucoma appeared in these animals.

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LOCAL APPLICATION OF DIAMOX*

An experimental study of its effect on the intraocular pressure

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Diamox† is a new carbonic anhydrase inhibitor which has been receiving much attention for its ability to lower intraocular pressure.[1] This effect has been obtained thus far with oral and intravenous administration. It is the purpose of this study to determine the effect on the intraocular pressure in rabbits' eyes with local instillation, subconjunctival injection, and the injection into the anterior chamber of Diamox solutions of varying strengths. It was felt that some endeavor should be made to determine if this substance can gain entrance into the eye in a form and concentration sufficient to exert its effect on the formation of aqueous humor.

It has been shown that the effect of this drug is probably a purely local one. It may lower the intraocular pressure independent of and even in the absence of any diuretic effect.[2] Even in nephrectomized animals could a pressure lowering effect be observed.[3] Local application of this enzyme could, therefore, conceivably affect the intraocular pressure and in this way eliminate the necessity of a systemic administration.

Experiment

Six young, white rabbits were used, weighing 1,440 gm. each. The normal intraocular pressure was established for both eyes in each rabbit with the Schiøtz tonometer prior to the use of Diamox.

Topical instillation

A one-percent solution of Diamox in normal saline was instilled daily for 30 days in the right eye of each rabbit, the left eye serving as a control. The intraocular pressure of both eyes in each rabbit was checked twice weekly. No change in intraocular pressure was produced as measured by the Schiøtz tonometer.

* From the Department of Ophthalmology, State University of Iowa.
† The drug was supplied by Lederle Laboratories Division, American Cyanamid Company.

TABLE 1

INSTILLATION OF ONE-PERCENT DIAMOX SOLUTION

Rabbit No.	1st Week		2nd Week		3rd Week		4th Week	
1	16.9	16.9	16.9	18.5	16.9	16.9	16.9	16.9
	18.5	16.9	16.9	16.9	18.5	18.5	18.5	16.9
2	16.9	16.9	16.9	16.9	16.9	20.1	16.9	16.9
	16.9	16.9	16.9	16.9	18.5	18.5	16.9	16.9
3	18.5	18.5	18.5	18.5	16.9	18.5	18.5	16.9
	18.5	18.5	18.5	18.5	18.5	18.5	18.5	16.9
4	16.9	16.9	16.9	16.9	16.9	18.5	20.1	18.5
	16.9	16.9	16.9	16.9	18.5	20.1	20.1	16.9
5	18.5	18.5	18.5	18.5	18.5	18.5	16.9	16.9
	16.9	16.9	18.5	18.5	16.9	18.5	18.5	18.5
6	16.9	16.9	16.9	16.9	16.9	18.5	16.9	16.9
	16.9	16.9	16.9	16.9	16.9	18.5	16.9	18.5

The strength of the Diamox solution was then increased to 10 percent in normal saline. Following the same procedure for another 30-day period, again no measurable change in intraocular pressure was noted.

It is of interest to note the complete absence of adverse local reactions with the instillation of either the one-percent or 10-percent solution of Diamox into the eyes. The conjunctiva remained white, the cornea, anterior chamber, and lens clear in all the treated eyes. The pupils remained round, regular, equal, and reacted normally to light. However, for a few minutes after instillation of the 10-percent solution there was apparently discomfort experienced after each application.

SUBCONJUNCTIVAL INJECTION

For the study of the effects of the subconjunctival injection, 0.1 cc. of a one-percent solution of Diamox in normal saline was injected subconjunctivally in the right eye of each of two rabbits after prior instilla-

TABLE 2

INSTILLATION OF 10-PERCENT DIAMOX SOLUTION

Rabbit No.	1st Week		2nd Week		3rd Week		4th Week	
1	18.5	16.9	16.9	16.9	16.9	16.9	16.9	16.9
	16.9	16.9	18.5	18.5	16.9	16.9	18.5	18.5
2	16.9	16.9	16.9	16.9	18.5	18.5	16.9	18.5
	16.9	16.9	16.9	18.5	16.9	18.5	18.5	16.9
3	18.5	18.5	18.5	16.9	18.5	18.5	18.5	18.5
	18.5	18.5	18.5	18.5	18.5	18.5	16.9	16.9
4	16.9	16.9	20.1	18.5	16.9	18.5	18.5	18.5
	16.9	16.9	20.1	16.9	18.5	16.9	18.5	18.5
5	16.9	18.5	18.5	18.5	16.9	16.9	16.9	16.9
	16.9	16.9	16.9	18.5	18.5	18.5	18.5	16.9
6	16.9	16.9	16.9	16.9	20.1	16.9	18.5	16.9
	16.9	16.9	16.9	18.5	18.5	18.5	16.9	16.9

TABLE 3

SUBCONJUNCTIVAL INJECTION OF ONE-PERCENT DIAMOX SOLUTION

Rabbit No.	2 hr.	6 hr.	24 hr.	30 hr.	48 hr.
1	16.9	16.9	18.5	18.5	18.5
	16.9	16.9	18.5	16.9	16.9
2	18.5	18.5	18.5	18.5	18.5
	20.1	18.5	20.1	18.5	20.1

tion of 0.5-percent pontocaine. The bleb disappeared within 24 hours without evidence of blanching or redness at the site. Serial tensions with the Schiøtz tonometer for 48 hours following injection revealed no change in the intraocular pressure.

Then 0.1 cc. of a 10-percent solution of Diamox in normal saline was injected subconjunctivally in the right eye of each of two different rabbits after prior instillation of 0.5-percent pontocaine. These blebs persisted for from 48 to 72 hours. There was moderate redness of the bulbar conjunctiva confined to the area injected for the first 24 hours. The injection was accompanied by some pain which persisted for several hours. Serial tensions with the Schiøtz tonometer for 48 hours following injection revealed no change in the intraocular pressure.

INTRACAMERAL INJECTION

To study the effects of intracameral injection, 0.1 cc. of a one-percent solution of Diamox in normal saline was injected into the anterior chamber of the right eye in each of two rabbits following the instillation of 0.5-percent pontocaine. There were no immediate or late signs of irritation or damage to either of the injected eyes during a three-week period of observation. Serial tensions with the Schiøtz tonometer for 48 hours following injection revealed no change in the intraocular pressure. The injection was apparently painless.

Then 0.1 cc. of a 10-percent solution of Diamox in normal saline was injected into the anterior chamber of the right eye in each of three different rabbits. Local instillation of 0.5-percent pontocaine was used as before. It was discovered with the first rabbit that more adequate anesthesia would be required, for the animal became wild and uncontrollable with pain. This rabbit was discarded.

The other two were given intravenous Nembutal until rendered semiconscious. Injection was then easily accomplished. Before the injection was completed, the corneas of both rabbits became steamy and semi-opaque. Within a few minutes tthe bulbar conjunctiva became injected and slightly edematous. These changes persisted for over one week with gradual clearing of the cornea and return of the bulbar conjunctiva to normal.

During a period of observation of three weeks there was no evidence of other damage or changes in the structures of the globe capable of being examined by inspection.

TABLE 4

SUBCONJUNCTIVAL INJECTION OF 10-PERCENT DIAMOX SOLUTION

Rabbit No.	2 hr.	6 hr.	24 hr.	30 hr.	48 hr.
3	18.5	18.5	20.1	20.1	20.1
	18.5	18.5	18.5	20.1	18.5
4	16.9	16.9	16.9	18.5	18.5
	16.9	18.5	18.5	18.5	18.5

TABLE 5

INTRACAMERAL INJECTION OF ONE-PERCENT DIAMOX SOLUTION

Rabbit No.	2 hr.	6 hr.	24 hr.	30 hr.	48 hr.
5	16.9	18.5	18.5	18.5	18.5
	16.9	16.9	18.5	16.9	18.5
6	16.9	16.9	18.5	16.9	18.5
	18.5	18.5	16.9	16.9	18.5

Tensions were not recorded. It was felt that the condition of the cornea in both rabbits would invalidate any readings obtained.

DISCUSSION

Our attempts to influence the intraocular pressure by the local application of Diamox did not meet with any success. This means that at the present time the treatment of glaucomatous eyes with local carbonic anhydrase inhibitors is of no value. This does not speak against the theory that this enzyme acts locally in the eye. It is possible that it is broken down after transfusing into the eye. This, however, should not impair the effect of an intracameral injection. It is quite likely, as has been pointed out by Friedenwald,[4] that the enzyme has to pass through the ciliary stroma in order to be effective on the ciliary processes.

SUMMARY

Diamox was instilled in one-percent and 10-percent solution into the conjunctival sac of rabbits. It was injected in a one-percent and 10-percent solution subconjunctivally and in a one-percent solution intracamerally. None of these local applications had any effect on the intraocular pressure. A 10-percent solution was also injected into the anterior chamber. It caused severe pain and marked, but temporary, clouding of the cornea.

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OPHTHALMIC MINIATURE

Again, good glasses ought to be, in all their parts, of an equal thickness, in proportion to their convexity, as well as of an equal form.

H. Colburn, London, 1816,
The Art of Preserving the Sight Unimpaired to an Extreme Old Age.

SYMPATHETIC UVEITIS*

A CLINICAL AND PATHOLOGIC STUDY OF THE VISUAL RESULT

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This report deals with a clinical and pathologic study of 257 cases of sympathetic uveitis proven histologically and gathered from the files of the American Registry of Pathology, Armed Forces Institute of Pathology, and the Wilmer Institute, The Johns Hopkins Hospital. The principal lesson derived from the study emphasizes the fact that routine enucleation of the exciting eye should not be done coincident with the onset of symptoms in the sympathizing eye. The data indicate that this procedure does not materially improve the final visual result for the patient but for a number of other reasons may be detrimental.

The word "indicates" is used advisedly because there are a number of unknowns inherent in the problem of sympathetic uveitis which makes it impossible to draw definitive conclusions from a survey of this sort no matter how large.

First among these is the fact that this disease is so infrequent that to gather any considerable number of cases requires the data of many different observers with all the limitations, variations, and inconsistencies that this implies.

Second, there is a definite proportion of error in the clinical diagnosis of sympathetic uveitis so that when an attempt is made to compare, for example, the effect of enucleation with cases in which enucleation is not done, one is confronted with the fact that an unknown number of the latter may not be sympathetic uveitis at all.

Third, in this group there were only a very few cases in which there was any statement of the prior vision or notation of preceding pathology in the sound eye. Both of these factors of course might influence the final vision which has been attributed solely to sympathetic uveitis.

* From the Department of Ophthalmology, University of North Carolina School of Medicine.

CLINICAL

Tables 1, 2, 3, 4, and 5 summarize the data regarding age, sex and race incidence, predisposing causes, and the types of operations from which sympathetic uveitis may result. They contain no new information but agree rather closely with the previously reported findings of many other authors including Fuchs,[1] Joy,[2] Verhoeff,[3] Woods,[4] and others.

One point of interest in the race incidence is the finding that approximately 11 percent of 239 cases of sympathetic uveitis occurred in Negroes. This figure agrees very closely with the proportion of Negroes in the general population and would indicate that the Negro race is no more or less susceptible to this disease than members of the white race. Unfortunately this study was not designed to elucidate this point so that there is no assurance that the sampling is broad enough to yield dependable conclusions in this regard.

Certain of the cases were found to follow various operations which have previously not been reported as exciting causes of sympathetic uveitis including paracentesis (two cases), cyclodialysis, retinal detachment, delimiting keratotomy, and freeing of iris adhesions (one case each).

The presence of a foreign body in a traumatized eye is a complicating factor which many ophthalmologists believe may predispose the eye to the development of sympathetic uveitis. In this series the presence of a foreign body was recognized clinically in 12 of 121 traumatic cases (10 percent). In seven of these cases the foreign body was removed, while in five it was allowed to remain with

TABLE 1

AGE INCIDENCE

Age	0–9	10–19	20–29	30–39	40–49	50–59	60–69	70–79	80	81
Number of Cases	32	26	35	28	29	37	35	23	1	1
Percent	48.9				51.1					

the subsequent development of sympathetic uveitis in all 12 cases.

In addition, foreign bodies were encountered microscopically in 17 more cases for a total of 29 (11 percent) in the entire series. Of the 17 microscopic foreign bodies 10 were cotton fibers, two were cilia, two were vegetable, and two were mineral. Of the cotton fiber foreign bodies six were in operative cases and four in traumatic cases, in two of which operative repair of the wound had been done.

It is not possible to deduce from all this exactly what role a foreign body may play in the precipitation of sympathetic uveitis. One would suppose that the retention of an irritating foreign body might predispose to sympathetic uveitis. On the other hand, removing a foreign body might precipitate sympathetic uveitis by further traumatizing the eye. It is possible to say, however, that an otherwise innocuous foreign body should not be removed from an eye with the single idea in mind of preventing sympathetic uveitis.

The visual results have been correlated with various clinical and pathologic factors. The treatment of most cases included cycloplegics and foreign protein therapy of one sort or another. The clinical reports available on these cases were not sufficiently detailed to allow correlation of visual results with any of the therapeutic agents used. None of the cases were treated with cortisone or corticotropin since the study period extended up through 1949 only. In 123 cases the vision at some time following enucleation was specified. Although the period was under one year in 23 cases, the average follow-up for vision was three years and four months.

Table 6 summarizes the visual result in these cases and agrees closely with previously reported findings of Fuchs,[3] Post,[5] Irvine,[6] and others. There is surprisingly close agree-

TABLE 2

SEX INCIDENCE

Number of Cases	Male	Female
	176	81
Percent	69	31

TABLE 3

RACE INCIDENCE

Number of cases	White	Negro
	212	27
Percent	89	11

TABLE 4

PREDISPOSING CAUSE IN EXCITING EYE

	No. of Cases	Percent
Traumatic wounds	121	54
Operative wounds	96	43
Perforating corneal ulcer	3	1.5
Malignant melanoma choroid	3	1.5

TABLE 5

TYPE OF OPERATION

	No. of Cases
Cataract extraction	53
All other	42
Iridectomy	15
Iris inclusion	15
Trephine	6
Paracentesis	2
Cyclodialysis	1
Retinal detachment	1
Delimiting keratotomy	1
Freeing iris adhesions	1

TABLE 6

VISUAL RESULT

Vision	20/20	20/30	20/40	20/50	20/70	20/100	20/200	H.M.	L.P.	Unspecified Not Blind	Blind	Total
Number of cases	34	14	4	2	3	10	5	13	7	12	19	123
Percent	27	11	4	2	3	8	4	10	6	10	15	100
	Percent of cases with visual result 20/70 or better 47					Percent of cases with visual result less than 20/70 53						

ment in all reported series that approximately 50 percent of cases of sympathetic uveitis retain useful vision. It is also encouraging to note from Table 6 that 27 percent of these 123 cases had a visual result of 20/20, almost twice as many as were left blind (15 percent).

Tables 7, 8, and 9 correlate the visual result with age, sex, and type of injury. As in previous reports the visual result in cases of sympathetic uveitis following cataract operation is considerably worse than that following other types of operations or injuries.

Table 10 summarizes the visual results with respect to the "incubation period" of sympathetic uveitis, that is the interval of time from the injury of the exciting eye to the onset of symptoms in the sympathizing eye. This time interval does not appear to be a significant factor in the visual result.

For many years it has been generally held

TABLE 7

CORRELATION OF VISUAL RESULT WITH AGE

Age of Patient at Onset of Sympathetic Uveitis	Number of Cases	Percent of Cases With Vision 20/70 or Better	Percent of Cases With Vision Less Than 20/70
Less than 40 years old	50	57	43
More than 40 years old	40	40	60

TABLE 8

CORRELATION OF VISUAL RESULT WITH SEX

	Number of Cases	Percent of Cases With Vision 20/70 or Better	Percent of Cases With Vision Less Than 20/70
Male	62	58	42
Female	34	32	60

TABLE 9

CORRELATION OF VISUAL RESULT WITH TYPE OF INJURY

Type of Injury	Number of Cases	Percent of Cases With Vision 20/70 or Better	Percent of Cases With Vision Less Than 20/70
Cataract operation	16	25	75
All other operations	10	40	60
Trauma	55	60	40

TABLE 10

CORRELATION OF VISUAL RESULT WITH INTERVAL FROM INJURY OF EXCITING EYE TO ONSET OF SYMPTOMS IN SYMPATHIZING EYE

Interval From Injury to Onset	Number of Cases	Percent of Cases With Vision 20/70 or Better	Percent of Cases With Vision Less Than 20/70
Less than 6 weeks	28	50	50
6 weeks to 1 year	38	33	66
More than 1 year	11	63	37

TABLE 11

CORRELATION OF VISUAL END RESULT WITH INTERVAL BETWEEN ONSET OF SYMPTOMS IN SYMPATHIZING EYE AND ENUCLEATION OF EXCITING EYE

Interval From Onset to Enucleation	Number of Cases	Percent With Vision Better Than 20/70	Percent With Vision Worse Than 20/70
Less than 48 hours	17	41	59
2 to 7 days	21	43	57
More than 1 week	32	50	50
Enucleation before onset of symptoms in sympathizing eye	7	29	71

that prompt enucleation of the exciting eye as soon as possible after the appearance of symptoms in the sympathizing eye offered the best hope for the retention of vision in the sympathizing eye. Table 11 was compiled to summarize the correlation of the visual end-result with the interval of time between the onset of symptoms in the sympathizing eye and enucleation of the exciting eye.

Table 11 also includes the visual end-result in seven cases where enucleation was carried out *before* the onset of symptoms in the sympathizing eye. Seventy-seven cases were available with information of this kind and the data indicate that the promptness with which enucleation is carried out does not materially affect the visual end-result. In fact, the seven cases in which enucleation was done before the onset of symptoms in the sympathetic eye fared considerably worse than the general average. Here especially the absence of information as to prior vision limits the significance of this observation in these seven cases.

Since the promptness with which enucleation is carried out does not appear to influence the final visual result in the sympathizing eye, it would be of interest to know whether enucleation improves the visual result at all as compared to the final vision in cases of sympathetic uveitis in which enucleation is not done. Such a comparison is difficult to make not only because of the rarity of the disease and the necessity of knowing the vision previously, but also because there is a considerable margin of error in the clinical diagnosis of sympathetic uveitis. Thus one can never be certain that all of the cases designated sympathetic uveitis on clinical grounds and in which enucleation is not done would still, in fact, be considered sympathetic uveitis on histologic grounds.

In spite of this, several authors have made such comparisons in the past. Table 12 reproduces figures taken from Joy,[7] in which the visual result in 126 cases of histologic sympathetic uveitis in which enucleation was done is compared with the visual result in 23 cases of clinical sympathetic uveitis in which enucleation was not done. These figures indicate that while enucleation would appear to improve the visual result in the one remaining sympathizing eye, this visual level is not appreciably better than the final vision in the better of the two eyes when enucleation is not done.

Irvine,[8] in 1940, reported useful vision in 55 percent of 42 cases of sympathetic uveitis in which enucleation was done as compared to useful vision in 53 percent of 17 cases in which enucleation was not done. Accordingly it would appear that enucleation coincident with or even before the onset of symptoms in the sympathizing eye does not appreciably improve the final vision.

TABLE 12

COMPARISON OF VISUAL RESULT IN CASES IN WHICH THE EXCITING EYE WAS ENUCLEATED WITH RESULT IN CASES IN WHICH IT WAS NOT ENUCLEATED

	Number of Cases	Visual Result 20/20–20/200	Visual Result 20/200–Blind
Cases in which exciting eye was enucleated	126	51.1	48.9
Cases in which exciting eye was *not* enucleated	23		
Better eye		52.6	47.4
Sympathizing eye		36.8	63.2

Taken from Joy, H. H.: New York State Journal of Medicine 36: 88, 1936.

TABLE 13

CORRELATION OF VISUAL END RESULT WITH INTERVAL BETWEEN INJURY TO EXCITING EYE AND ENUCLEATION OF EXCITING EYE

Interval from Injury to Enucleation	Number of Cases	Percent With Vision Better Than 20/70	Percent With Vision Worse Than 20/70
Less than 90 days	40	50	50
More than 90 days	32	37.5	62.5

x^2 (corrected) = 0.3344 P = 0.60

Another disturbing factor in the handling of sympathetic uveitis has been the concept that there may be a "spill over" of an injurious agent from the exciting eye that makes the disease more severe or prolonged in the sympathizing eye and that for this reason enucleation should not be delayed. Joy[7] supported this idea because the vision in the sympathizing eye in his 23 cases in which enucleation was not done was noticeably worse than in the sympathizing eye of the cases where the exciting eye had been removed. Irvine[8] did not agree because the visual result in his two groups was much the same. If the "spill over" idea were correct, one would expect that the longer enucleation was delayed, the worse the visual result in the sympathizing eye would be.

Table 13 summarizes the data in 72 cases of sympathetic uveitis comparing the visual result with the time between the injury and enucleation. The findings would seem to suggest that the visual result is worse if enucleation is delayed for 90 days or longer. However, statistical analysis reveals that a distribution of results such as is shown in Table 13 can be expected to occur 60 percent of the time by chance alone so that the data cannot be said to support the "spill over" hypothesis.

PATHOLOGY

An attempt has also been made to correlate the pathologic appearance of the exciting eye with the visual end-result in the sympathizing eye. The classic histologic characteristics of sympathetic uveitis including especially the presence of epithelioid cells or their derivatives were required for inclusion of each case in this study. If epithelioid cells could not be found in the sections at hand, the case was excluded from the study. Thus, undoubtedly, some cases of sympathetic uveitis were discarded inasmuch as serial sections or tangential or flat sections of the choroid will occasionally pick out a clump of isolated epithelioid cells when routine sections fail to disclose them.

The visual result in the sympathizing eye did not correlate with the degree of severity of general infiltration in the uvea of the exciting eye, nor did the location of the infiltration primarily in the anterior or posterior uvea in the exciting eye appear to be correlated with the visual result in the sympathizing eye.

Damage to the lens in the exciting eye did not correlate with the final visual result in the sympathizing eye.

Two pathologic factors in the exciting eye did appear to correlate with the visual result in the sympathizing eye. These were the degree of infiltration with epithelioid and giant cells and the degree of pigment phagocytosis.

Tables 14 and 15 summarize the correlation of these two factors in the exciting eye with the visual result in the sympathizing eye. In general where the exciting eye had only very few epithelioid and giant cells the

TABLE 14

CORRELATION OF PATHOLOGY OF EXCITING EYE WITH VISUAL END RESULT IN SYMPATHIZING EYE

Degree of Infiltration of Epithelioid & Giant Cells	Number of Cases	Percent With Vision 20/70 or Better	Percent With Vision Less Than 20/70
Light	4	75	25
Moderate	26	57	43
Moderately heavy	15	33	66
Very heavy	4	0	100

x^2 = 7.131 P = 0.07

TABLE 15

CORRELATION OF PATHOLOGY OF EXCITING EYE WITH VISUAL END RESULT IN SYMPATHIZING EYE

Degree of Pigment Phagocytosis	Number of Cases	Percent With Vision 20/70 or Better	Percent With Vision Less Than 20/70
Light	4	25	75
Moderate	33	54	46
Moderately heavy	9	22	78
Very heavy	2	0	100

$\chi^2 = 4.531 \quad P = 0.22$

visual result in the sympathizing eye was better than in cases where the infiltration of the exciting eye with epithelioid and giant cells was very heavy.

A similar correlation with the degree of pigment phagocytosis evident in the exciting eye and the visual result in the sympathizing eye was noted. If the pigment phagocytosis was light in the exciting eye, the prospects of a good visual result were better than if a heavy degree of pigment phagocytosis was found. Statistical analysis of Tables 14 and 15 indicates that the distribution noted might occur by chance alone, seven percent of the time in the first case and 22 percent in the latter case.

COMMENT

For a little over 90 years now it has been well understood by ophthalmologists that enucleation of an injured eye shortly after the injury was an effective preventive of sympathetic uveitis. The "safety period" is generally considered to be about two weeks although rarely cases of sympathetic uveitis occur where enucleation was done within two weeks of the date of injury. This clinical principle remains as true today as ever and is the only effective preventive of sympathetic uveitis we have.

For many years it has also been generally thought that should sympathetic uveitis develop in the sound eye, prompt enucleation of the injured eye could shorten or modify the course of the disease in the sympathizing eye. The validity of this concept has been difficult to test because of the relative infrequency of sympathetic uveitis and the necessity therefore of gathering case histories from a wide variety of sources.

In the present study the date of onset of symptoms in the sympathizing eye and the date of enucleation of the exciting eye are known in 77 cases and a comparison of the final vision in these cases indicates that the promptness with which enucleation is carried out after the onset of symptoms in the sympathizing eye does not affect the ultimate vision. Thus in 17 cases enucleated within 48 hours of the onset of symptoms in the sympathizing eye, 41 percent had a visual result of 20/70 or better as compared to 47 percent in the series as a whole. In this group the promptness with which enucleation of the exciting eye was done after the onset of symptoms in the sympathizing eye did not improve the final vision in the one remaining eye above that of the series as a whole.

The value of routine enucleation in sympathetic uveitis has been questioned before by a number of authors both here and abroad,[6, 7] and it has been stated on good authority[4] that except where the exciting eye is blind or nearly so enucleation, once the process is well under way in the sympathizing eye, is a valueless procedure since the exciting eye may eventually have the better vision.

In addition there are a number of reasons why enucleation should not be done in cases of sympathetic uveitis. In the first place, there is a considerable error in the clinical diagnosis of sympathetic uveitis,[8] probably amounting to about 10 percent. Subjective sympathetic irritation alone in the sound eye may occur without clinical evidence of the uveitis in this eye at any time. Lens-induced uveitis in the injured eye may simulate sympathetic uveitis in this eye. Phacoanaphylactic uveitis in the sound eye may be mistaken for sympathetic uveitis. Furthermore, it is only to be expected that intercurrent uveitis of varied etiology might appear at any time following an injury in one or both eyes.

In circumstances such as these a mistaken diagnosis of sympathetic uveitis could lead to enucleation of a potentially good eye for no purpose. On the contrary, even when sympathetic uveitis does exist, the combined experience of the past indicates that useful vision may be anticipated in 50 percent of cases whether or not enucleation is done.

The prospect for final vision in sympathetic uveitis is even better today, inasmuch as it is evident that sympathetic uveitis can be controlled at least to some extent by cortisone and adrenal corticotropic hormone. Haik, Waugh, and Lyda,[3] reporting the collected experience of 58 ophthalmologists, found that in 72 patients with sympathetic uveitis a favorable result was observed in 64 percent under treatment with cortisone or adrenocorticotropic hormone. About 40 percent of these later had a relapse, but this could usually be controlled by further therapy. It is to be expected, therefore, that the use of these hormones should improve the final visual results in these cases over what might have been expected in the past.

Summary and Conclusions

The following conclusions are suggested from a clinical and pathologic study of 257 cases of sympathetic uveitis:

1. Foreign bodies were recognized clinically in 12 of 121 traumatic cases (10 percent). In seven of these cases the foreign body was removed while in five it was allowed to remain with the development of sympathetic uveitis in all 12 cases. An otherwise innocuous foreign body should therefore not be removed from an eye with the single idea in mind of preventing sympathetic uveitis.

2. At least 50 percent of cases of sympathetic uveitis may be expected to retain useful vision. In this series (123 cases) 47 percent had 20/70 or better; 27 percent had 20/20 or better; 15 percent were blind.

3. Prompt enucleation of the exciting eye after the onset of symptoms in the sympathizing eye did not materially affect the 50-50 visual result in 77 cases.

4. The visual result in the sympathizing eye did not correlate with a histologic estimation of the degree of severity of the inflammation in the exciting eye nor with its location primarily in the anterior or posterior uvea. Damage to the lens in the exciting eye did not correlate with the final visual result in the sympathizing eye.

5. The final vision in the sympathizing eye was considerably better when few epithelioid cells were present in the exciting eye and when pigment phagocytosis was light in this eye.

6. Enucleation coincident with the onset of symptoms in the sympathizing eye does not improve the final vision available to the patient above that which can be expected without enucleation.

7. It is advocated that when sympathetic uveitis does occur, enucleation of the exciting eye should not be done (except when this eye is blind or nearly so) because:

   a. There is an appreciable error in the clinical diagnosis of sympathetic uveitis.
   b. Enucleation can only be harmful when sympathetic uveitis does not exist and does not improve the final visual result when sympathetic uveitis does exist.
   c. Cortisone and adrenal corticotropic hormone provide a degree of control of sympathetic uveitis not previously obtainable with the classic methods of treatment.

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RESULTS WITH MOTILITY IMPLANTS

The fate of 199 motility implants six months to six years after emplacement

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The near saturation of ophthalmic literature with articles on implants after the removal of the eye indicates both the intense interest in this subject and the many problems yet unsolved. Most of the papers are descriptions by various authors of the implants they have devised. In 1951, the American Academy of Ophthalmology and Otolaryngology presented a symposium on "Orbital implants after enucleation" which covered the knowledge available in this field at that time. In his 1953 review of contributions on the orbit, DeVoe indicated the general preference for buried implants.

This report has been organized into two tables (1 and 2) which show the successes and failures with 199 motility implants, both of the integrated (also called semiburied and exposed) and the buried type at the Thigpen Cater Eye Hospital, the Ophthalmological Department of the Medical College of Alabama, from September, 1947, through December, 1953. During this time, 343 spherical implants of methyl methacrylate were emplaced beneath Tenon's capsule and the conjunctiva. Of the latter group, there were seven (known) extrusions.

The patients were from the private practices of the members of the attending staff and the various charity services of the Department of Ophthalmology, including the Alabama Sight Conservation Association and the Crippled Children's Division of Vocational Education.

Fig. 1 (Callahan). *Extruding Stone-Jardon implant.* In a five-year-old boy, the left eye was enucleated for phthisis following panophthalmitis five weeks previously. No operative complications occurred, and the postoperative course was uneventful. Good motion resulted and the appearance for six months was excellent. Then a purulent discharge developed (*B. pyocyaneus* was cultured) and increased despite intensive antibiotic and sulfa therapy. The patient constantly wiped away ropy discharge. Eleven months after the insertion of the implant, the medial rectus tendon became detached from it. The orbital tissues were exposed, showing acute and chronic inflammatory changes. The Stone-Jardon implant was removed and a small sphere of methyl methacrylate was inserted into the cavity left by the extruded implant and the conjunctiva and Tenon's capsule were closed over it. It has now remained in the orbit for four years.

TABLE 1

FATE OF 112 INTEGRATED IMPLANTS

Type of Implant	Emplaced	Extruded	Remarks
Johnson	19	1 *	The tantalum ring fixing the conjunctiva and Tenon's capsule to the neck of the implant is an important feature of this type. The one extruded implant resulted from a fourth postoperative day hemorrhage which may have been due to the excessive inflammatory and neovascular orbital tissues which had developed around the degenerating eye
Cutler	3	0	The conjunctiva and Tenon's capsule are fastened to the neck with a permanently emplaced suture
Stone-Jardon	82	21	The usual mechanism for loss is persistent infection, retraction of conjunctiva and Tenon's capsule, exposure and separation of tendons from tantalum mesh. Most of those lost, were inserted 5–6 years ago. Not all patients were well selected; 15 were children
AO integrated	5	0	This type has been withdrawn from the market because of patent difficulties
Stone-Jardon, secondary type (smaller and with tantalum prongs)	2	1	Very friable tissues and retraction of the conjunctiva caused the loss of one of these implants
Cutler ring	1	1	This was an important step in the evolution of implants

TABLE 2

FATE OF 87 BURIED (MOTILITY) IMPLANTS

Type of Implant	Emplaced	Extruded	Remarks
1. After enucleation			
Buried AO (flat top)	11	1	This is one of the best types of buried implants
Allen	58	5	Four of these were lost, probably from excessive overlapping of tendons. The prosthetic eye moves adequately in a 10-degree field
Polyvinyl plastic sponge	7	4	In one, the sponge split apart in the middle with half remaining attached to each horizontal rectus tendon and the conjunctiva overlying it became atrophic and sloughed, opening the sponge to infection. The others were lost by erosion
Troutman magnetic	2	2	Troutman has implanted several hundred magnetic implants successfully, with very few losses
Radin Rosenthal	3	0	No erosion of the conjunctiva over the tantalum has occurred
2. After evisceration			
Rosa scleral	6	1	The socket is large and there is good motion of the prosthetic eye

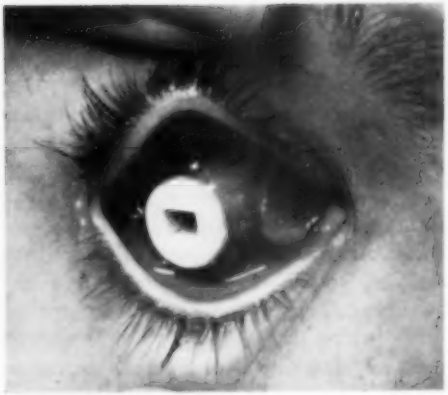

Fig. 2 (Callahan). *Extruding Stone-Jardon implant.* In a 14-year-old boy, the right eye was removed for phthisis bulbi which followed an injury and a Stone-Jardon implant was implaced. In a few months the conjunctiva and Tenon's capsule retracted, probably as the result of the removal of the purse-string suture holding these structures to the edge of the implant's face. Seven months after the implant was placed in the orbit, a surgical attempt to replace the conjunctiva and Tenon's capsule up to the edge of the face of the implant was made. Soon after this, a persistent greenish discharge (B. pyocyaneus was cultured) developed. The medial rectus tendon became detached 31 months after the emplacement of the implant. The other three tendons were disconnected surgically and the implant removed. A small sphere of methyl methacrylate was inserted into Tenon's capsule and this structure and the conjunctiva were closed over it. However, two weeks later it was extruded.

Conclusions

It is generally acknowledged that integrated (also termed exposed, or semiburied) implants impart better motility than the buried type, yet that they are more insecure because the orbits in which they are placed are subject to infection.

From these studies we have learned the following:

1. The conjunctiva tends to contract away from the face of an integrated implant and cicatrize toward the fornices. To offset these forces, the conjunctiva and Tenon's capsule must be held securely at the margin of the implant face with a permanently placed clamp or suture. The tantalum ring clamp is excellent; of suture materials, nylon is probably the best. Many an integrated implant now extruded would still be in its orbit had the conjunctival suture not been removed.

2. Cotton or silk sutures are excellent for the attachment of the tendons to the implant if they are not exposed. Nylon suture seems best when the material must lie outside of the conjunctiva. Chromic gut sutures are contraindicated for union of tendons and im-

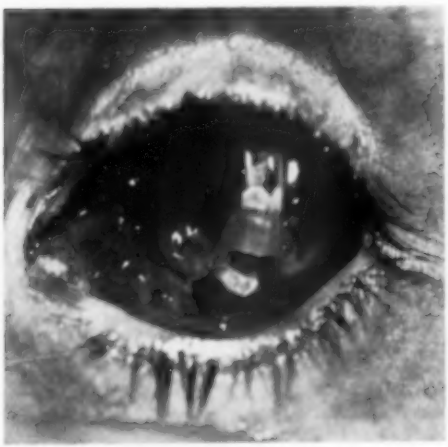

Fig. 3 (Callahan). *Extruding Allen implant.* In a 23-year-old woman, the left eye was removed following complications after an injury. An Allen implant was emplaced at this time, the rectus tendons being overlapped four mm. Seven months later the patient felt something "give" in her socket and the prosthetic eye was dislodged nasally and fell out. She noted that part of the implant was exposed but she delayed visiting the ophthalmologist until two months later. The attachment of the lateral rectus was eroded away but the other rectus tendons were holding firmly. Under local anesthesia obtained with the procaine-epinephrine-hyaluronidase mixture, the other tendons were detached and the implant removed. A small hemisphere of methyl methacrylate was inserted into the cavity. The conjunctiva and Tenon's capsule were closed without undue tension over it but, 10 days later, this was extruded.

Fig. 4 (Callahan). *Split Ivalon implant.* In a 65-year-old white man, the right eye was removed for absolute glaucoma. A pyramidal-shaped piece of polyvinyl sponge was inserted according to Pearlman's technique. After three weeks, it was seen that the sponge had split apart in the middle with half remaining attached to each horizontal rectus tendon. The conjunctiva overlying the face of the buried implant became atrophic and sloughed; an attempt to reunite the conjunctival edges was unsuccessful.

plant for the gut may dissolve before firm fibroblastic attachment has occurred.

3. Tantalum mesh promotes fibroblastic proliferation and should be utilized where strong adhesions are desired. However, if the mesh extends behind the desired point of attachment, late limitation of motion of the implant will result.

4. Prongs on integrated implants provide successful union when the tendons are impaled over them.

5. Tantalum wire suture for the attachment of the tendons to the implant is contraindicated, for it is subject to fragmentation and the ends will erode through the conjunctiva and the tendon will retract from the mesh.

6. An antibiotic ointment such as aureomycin or polysporin, should be instilled inside the lower lid every night. Every morning, the socket should be copiously irrigated with an antiseptic such as Zephiran® chloride (aqueous 1:1,000). Ideally, the prosthetic eye should not be removed more often than once a week for cleansing behind it. The patient's fingers must never be allowed to touch the lids.

7. When an integrated implant is extruded, the socket shrinks and becomes markedly contracted and deformed. Movement of the prosthetic eye is usually poor afterward.

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Ophthalmic Miniature

The experiments adduced by Dr. Franklin . . . were most ingeniously contrived and happily executed. A singular felicity of induction guided all his researches, and by very small means he established very grand truths. . . . He has in no case exhibited that false dignity by which philosophy is kept aloof from common applications.

Sir Humphrey Davy: *Collected Works*, 1840, vol. 8, pp. 264-265.

CRITERIA FOR THE MANAGEMENT OF ALTERNATING STRABISMUS*

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When we reviewed the literature on convergent strabismus, we were impressed by the relative paucity of information on alternating esotropia. Since one of the primary objectives in the management of uniocular convergent strabismus is the conversion of these cases to alternation by improving the vision of the amblyopic eye, we feel that a knowledge of alternating esotropia will also help in the treatment of uniocular strabismus. Consequently it seemed advisable to study in detail a group of cases of alternating esotropia in order to learn about the nature of, and possible avenues of treatment for, this condition.

In selecting material for this study we have included only those patients who have demonstrated the ability to alternate fixation, even though they may have preferences for one eye or the other. This includes the so-called "true alternators" who have no preferences for fixation. The present study includes a survey of 230 consecutive cases from the Department of Motor Anomalies of the New York Eye and Ear Infirmary.

I. CHARACTERISTICS OF ALTERNATING ESOTROPIA

1. AGE OF ONSET

It is generally believed that the majority of cases have their onset in the first year of life. Since the accuracy of these data depends on the observational acumen of the parents, one cannot place too much credence upon our findings in this respect. Nevertheless, when we tabulated our cases according to the age of onset, there was a close correlation between our percentages and those of Worth.[1] While 32 percent of our patients apparently began to squint in the first year of life, and 21 percent in the second year, 47 percent had their onset after the second year (table 1). Keiner,[2] on the other hand, found that 63 percent of the alternators developed esotropia in the first year of life, while 25 percent had their onset in the second year.

2. VISUAL ACUITY AND DOMINANCE

The majority of cases had equal vision in both eyes; 79.3 percent of the cases had a definite preference for one eye. Only 12.9 percent were "true alternators" in that they showed no preference for either eye, and another 4.6 percent preferred one eye for distance and the other for near.

It is generally acknowledged that the patient prefers fixation with the eye having the least refractive error or the least amount of astigmatism. This was true in 31 percent of the cases (table 2). On the other hand, 11.5 percent of the patients preferred to fixate with the eye which had the greater refractive error; 57.5 percent of the patients showed the same refractive error in both eyes.

3. RELATION OF THE REFRACTIVE ERROR TO THE STRABISMUS

The incidence of various degrees of hypermetropia, using spheric equivalents, is given in Table 3. It can readily be seen that there are more relatively high hypermetropic individuals among alternators than in an average

* From the Department of Motor Anomalies of the New York Eye and Ear Infirmary. Presented before the New York Society for Clinical Ophthalmology, April 5, 1954.

TABLE 1

AGE OF ONSET IN ALTERNATING ESOTROPIA

Age (yr.)	No. of Cases	Percentage	Worth[1] Percentage (100 cases)
Birth to 1	64	32.0	34
1–2	42	21.0	19
2–3	27	13.5	13
3–4	33	16.5	16
4–5	17	6.5	6
5–6	11	5.5	4
Over 6	6	3.0	8
TOTAL	200		

cross-section of the population, but fewer high hypermetropic individuals than in all convergent squinters (including both uniocular and alternating).

It is of passing interest to note that we had five cases with myopia of which two measured −10.0D. and −12.0D. There were only three cases with anisometropia over 3.0D.

Astigmatism of 1.0D. or more in one or both eyes was present in 39.5 percent of the cases. This is five percent greater than the incidence reported by Chavasse[3c] who included cases of 0.5D. and more.

In alternating esotropia, as in esotropia in general, the correction of the refractive error plays an important part in reducing the amount of deviation. Althqugh the great bulk of purely accommodative cases were not included in our series of 230 cases because they are uniocular, nevertheless 7.7 percent of the cases were rendered orthophoric by glasses; 39 percent were partially accommodative; and 27.2 percent were nonaccommodative. In 26.1 percent the patients did not wear the glasses long enough prior to surgery to permit any conclusions. Also, there were a number of cases with refractive errors of +1.0D. and +1.25D. where glasses had not been prescribed.

TABLE 2

RELATION OF FIXATING EYE TO REFRACTIVE ERROR

	No. of Cases	Percentage
No difference in refractive error between both eyes	111	57.5
Prefers fixation with eye with lesser refractive error	42	21.7
Prefers fixation with eye with greater refractive error	18	9.3
Prefers fixation with eye with lesser amount of astigmatism	18	9.3
Prefers fixation with eye with greater amount of astigmatism	4	2.2
TOTAL	193	100.0

In the group partially corrected by glasses, 73.6 percent had hypermetropia ranging from 2.25D. to 5.0D. (table 4); 53.9 percent were in the group with hypermetropia between +2.25D. and +4.0D. In the nonaccommodative group, however, 54.6 percent had refractive errors ranging from 0.0D. to +2.0D., and 78.9 percent ranged from 0.0D. to +3.0D. Nevertheless, 21.1 percent of the cases were in the nonaccommodative group with hypermetropia of 3.25D. to 6.0D.

There was no relation between the amount of deviation and the amount of refractive error.

It is noteworthy that in one patient, who was observed over a period of seven years, there was a change in refractive error from +1.0D., O.U., to −0.75D., O.U.

II. MEDICAL TREATMENT OF ALTERNATING ESOTROPIA

The treatment of alternating esotropia is identical to that of uniocular esotropia and follows the time-honored rules for the treatment of convergent strabismus. Since vision is often equal in both eyes, amblyopic train-

TABLE 3

COMPARATIVE INCIDENCE OF VARIOUS DEGREES OF HYPERMETROPIA IN ALTERNATING ESOTROPIA, ALL TYPES OF ESOTROPIA, AND THE GENERAL POPULATION

Refractive Error (diopters)	Alternating Esotropia (Schlossman and Shier)		All Types of Esotropia[25]		General Population[25]
	No. of Cases	Percentage	(Worth) Percentage	(Lagleyze) Percentage	(Chavasse) Percentage
0 to +1.00	24	12.4	6.0	1.3	34.5
+1.25 to +2.00	41	21.2	10.2	13.7	37.0
+2.25 to +3.00	48	24.9	17.4	21.7	15.0
+3.25 to +4.00	39	20.4	20.6	21.9	7.0
+4.25 to +5.00	24	12.4	36.3*	23.8*	1.5
+5.25 to +6.00	12	6.2			0.5
+6.25 to +7.00	2	1.0	7.4†	9.1†	1.0
+7.25 and higher	3	1.5	1.0‡	2.4‡	
TOTAL	193				

* +4.00 to +6.00 diopters.
† +6.00 to +8.00 diopters.
‡ +8.00 to +10.00 diopters.

ing is not as important in alternating esotropia as it is in uniocular esotropia. However, alternating suppression is always present and can only be treated by orthoptic training, if at all.

The fact that there were 15 cases which were rendered orthophoric simply by wearing their full correction, and another 76 cases which were partially accommodative, shows the importance of a complete knowledge of the refractive status prior to any consideration of surgical intervention.

We believe that the patient should wear his full atropine correction for at least four months prior to surgery, and during this period at least two atropine refractions should be performed. It is quite possible that a mother who has difficulty in handling her child may be unable to instill the atropine as directed, resulting in incomplete cycloplegia. As an illustration, in one of the cases the first atropine refraction showed hypermetropia of +1.25D. ⌒ +0.75D. cyl. ax. 90°, O.U.; and one month later, when the refraction was repeated, the result was +6.0D. ⌒ +0.75D. cyl. ax. 90°, O.U. There were several similar experiences.

Unlike accommodative and uniocular eso-

TABLE 4

COMPARATIVE INCIDENCE OF VARIOUS DEGREES OF HYPERMETROPIA IN NONACCOMMODATIVE AND PARTIALLY ACCOMMODATIVE ALTERNATING ESOTROPIA

Refractive Error (diopters)	Partially Accommodative		Nonaccommodative	
	No. of Cases	Percentage	No. of Cases	Percentage
0 to +1.00	0	0.0	16	30.3
+1.25 to +2.00	8	10.5	13	24.3
+2.25 to +3.00	21	27.6	13	24.3
+3.25 to +4.00	20	26.3	6	11.6
+4.25 to +5.00	15	19.7	4	7.6
+5.25 to +6.00	10	13.3	1	1.9
+6.25 to +7.00	1	1.3	0	0.0
+7.25 and higher	1	1.3	0	0.0
TOTAL	76		53	

tropia, orthoptic training plays a minor role in the treatment of alternating convergent strabismus. In most cases the ophthalmologist is satisfied to obtain a good cosmetic result, and there are relatively few cases where postoperative orthoptic training is indicated.

III. The surgical management of alternating esotropia

1. Amount of surgery to be performed

A certain amount of confusion has been introduced into the surgical treatment of esotropia because various authorities advocate different surgical procedures for the same type of strabismus. For example, Burian[4] bases his surgical approach on the horizontal rotations depending upon whether there is an excess of adduction or a deficiency in abduction; and in alternating esotropia he relies more on resections of the lateral rectus muscles than on recessions of the medial rectus muscles. Chandler[5] divides alternating esotropia into four types and uses the resection operation only in one of the types. In the other groups he advises recessions of the medial rectus muscles or combinations of recessions and resections. Prangen[6] advocated recessions and resections for esotropia.

Dunnington and Regan[7] and Chandler put great emphasis on the near-point of convergence in planning surgery, while Burian places no reliance on this finding. White and Brown[8] have advocated surgical correction of the vertical component prior to operation on the horizontal component. On the other hand, Dunnington and Regan, Post,[9] Burian, and Schlossman[10] feel that the horizontal component should be corrected first in those cases in which the horizontal is greater than the vertical deviation.

While attempts have been made by many authorities[11–13] to correlate in arc degrees the amount of correction obtainable by a given amount of recession or resection measured in mm., this type of approach has given variable results and therefore proved to be of little value. Schlossman and Priestley[14] have shown that equal amounts of recession and resection often give different results in patients exhibiting apparently equal amounts of measured deviation, and that different types and amounts of surgical intervention may produce identical results in cases with similar measurements.

The following two cases illustrate how equal amounts of surgery may give different results:

K. K., aged four years, had an esotropia for distance and near of 90Δ. A three-mm. bilateral recession of the medial recti resulted in an immediate correction to 8Δ of esotropia which gradually diminished spontaneously to orthophoria within one year and maintained that status up to the present time, four years later.

On the other hand, A. L., of approximately the same age, also had an esotropia of 90Δ. A bilateral recession of three mm. of the medial recti was performed but a residual esotropia of 50Δ remained. Three months later a nine-mm. bilateral resection of the lateral recti was performed, and one year later the child still had an esotropia of 40Δ for distance and 65Δ for near.

The following three cases demonstrate how different types and amounts of surgery may produce almost equal results in similar cases:

R. K. had a residual deviation of 30Δ of esotropia for distance and 38Δ for near after correction with glasses. A two-mm. recession of the right medial rectus was performed, and, over a five-year follow-up, the child maintained a result of 3Δ of esotropia for distance and a slight exophoria for near.

C. B. had 30Δ of esotropia for distance and 40Δ for near, after correction with glasses. A bilateral four-mm. recession of the medial recti was performed and, over an 11-year follow-up, this patient maintained an esophoria of 8Δ for distance and 10Δ for near.

I. E. had 35Δ of esotropia for distance and near after correction with glasses. A 2.5 mm.

recession of the left medial rectus and an eight-mm. resection of the left lateral rectus were performed. Two years later the patient had a residual esotropia of 5Δ.

It is generally true that larger amounts of esotropia require greater amounts of surgery. Nevertheless, there is neither an arithmetic nor a geometric relationship between the amount of deviation and the amount of surgery required.

In 12 cases with an esotropia between 10 and 20 diopters, there was an average of 2.09 muscles operated on per case (there was only one overcorrection in this group, and that was an exotropia of 8Δ), whereas in the group measuring 70Δ to 90Δ of esotropia, an average of 3.3 muscles was operated on.*

It is of interest that deviations as small as 10 to 12 diopters required so much surgery. This is in accord with the concept that the effect of surgery is greater in patients with larger deviations than it is in those with smaller deviations.

2. Bilateral recession versus recession-resection

There has been a great deal of discussion as to the relative merits of the routine bilateral medial rectus recession as against the recession of the medial rectus and resection of the lateral rectus. Bilateral recessions have the cosmetic advantage of a greater range of ocular motility without limitation of ductions in lateral gaze. On comparing the results of these two types of procedure, there was an equal percentage of good results from the point of view of residual heterotropia in the primary position. For this reason, because bilateral recessions give better cosmetic results, they would seem to have an advantage.

Fifty percent of the cases, however, had a deviation greater than 10Δ following the first operation, and many of these required additional surgery. It is therefore obvious that, if supplementary surgery has to be performed on a patient who has had a bilateral recession, the usual procedure is to operate on one or both lateral recti. Thus, in effect, the patient will have been subjected to a recession-resection operation anyway.

If, following a bilateral recession, a considerable amount of residual esotropia remains, resections of the lateral recti probably will not suffice to reduce the strabismus adequately. As a consequence, further recessions of one or both medial recti will be unavoidable.

On the other hand, if a recession-resection procedure does not satisfactorily correct the esotropia, the surgeon can operate on the fellow eye and, by utilizing the experience obtained by similar surgery on the first eye, he can plan the second operation in a better manner. Therefore, it is obvious that for the average ophthalmologist the greater flexibility of the recession-resection procedure outweighs the cosmetic advantages of the bilateral recession.

3. Factors which influence surgery

Aside from the purely accommodative cases which do not require surgery, there is a significant percentage of cases in which the amount of deviation is partially reduced by the patient's wearing the full refractive correction as determined under effective atropine cycloplegia.

We have compared those cases in which at least 50 percent or more of the deviation was corrected by glasses with those cases in which less than 50 percent of the deviation was reduced by glasses. All but two of the 20 patients with 50-percent reduction in the amount of strabismus had 10Δ or less residual heterotropia following surgery, as compared with only two thirds of the 48 cases which showed less than 50-percent reduction by glasses. The type of surgery which was performed did not seem to matter so long as it was reasonable for the particular case.

It appears that if at least 50 percent of the

* In general, the recessions of the medial recti were between two and four mm., and the resections of the lateral recti were between eight and 10 mm.

esotropia is corrected by spectacles, one can expect a good surgical result. Where the refractive error does not play so great a role in reducing the amount of esotropia, other factors must be considered when planning surgery.

In a certain number of cases the measurements, as determined by alternate screening of both eyes, are greater than those obtained by covering one eye only. In other words, the amount of deviation is greater with alternate fixation than it is with uniocular fixation.

The clue to the detection of these cases is that they appear relatively less strabismic than their measurements indicate. Of course one must ascertain that the angle kappa in each eye is within the normal limits of zero to five degrees. This group of cases requires a smaller amount of surgery than would seem to be indicated from measurements derived by alternate screening. An important point here is a knowledge of the dominant eye, and the surgery should be aimed at reducing that error which is present when the dominant eye is fixing.

The literature is replete with statements putting great emphasis on the near-point of convergence in planning surgery. The determination of the near-point of convergence is at best nothing more than an estimation and depends not only on the co-operation of the child but also upon the fact that a maximal voluntary effort of convergence must be elicited in order to have a true determination.

Another factor involved is the type of accommodative target which is used. For instance, if a child is fixating a small object, his near-point of convergence is usually much better than when he fixates a light. Burian has shown, from a theoretic viewpoint, that there is no correlation between the near-point of convergence and the extent to which each medial rectus muscle is capable of adducting the eyeball.

Out of 122 near-points of convergence which were determined, 98 were under 40 mm. or within normal limits. Another 17 were over 40 mm. but under 60 mm., and only seven were over 60 mm. We feel that the near-point of convergence may have significance, in the consideration of surgery, only when it is over 60 mm. Resection of the lateral recti is the operation of choice in the presence of a remote near-point of convergence. However, if the deviation is very large it may still be necessary to recess one or both medial rectus muscles.

The following case illustrates the value of lateral rectus surgery:

N. C., a 29-year-old woman, had an esotropia of 50$^{\Delta}$ for distance and 25$^{\Delta}$ for near. She was emmetropic and her near-point of convergence was 200 mm. A bilateral resection of the lateral recti reduced the strabismus to an esotropia of 10$^{\Delta}$ for distance and 2$^{\Delta}$ for near.

Since strabismus is inherited in 47.5 percent of the cases, it is advisable to obtain a complete family history and, if one of the members has had surgery, to find out the details in reference to the amount of original deviation, the amount and type of surgery employed, and the final result. According to Schlossman and Priestley, the information which can be gleaned from the end-results of surgery on one member of a family in which similar types of squint prevail, is probably the safest guide in planning surgical correction on another member of the same family.

4. Cases which require no surgery or very little surgery

There are two groups of cases in which surgery should be considered only with the greatest caution.

The first group is comprised of those patients who measure only a very small amount of deviation for distance but a much greater amount for near. If the deviation for distance is 10$^{\Delta}$ or less with glasses, we do not believe that surgery is indicated and the patient should be given bifocals and orthoptic train-

ing. Where the deviation for distance is greater than 10$^{\Delta}$ with glasses, the extent of surgery should be planned in order to correct the distance esotropia without regard to the amount of deviation for near. Preoperatively and postoperatively, the near deviation should be treated with bifocals and orthoptic training.

Since the deviation for near is so much greater than that for distance, the surgeon may feel that he should plan his operation to correct the deviation for near. The inherent danger in this approach is that one runs the grave risk of an overcorrection for distance at the expense of a good correction for near. This point is illustrated by the following example:

A. C., aged seven years, had an esotropia of 15$^{\Delta}$ for distance and 60$^{\Delta}$ for near without glasses, and 10$^{\Delta}$ for distance and 35$^{\Delta}$ for near with glasses. The refractive error was: R.E., +4.5D. $\bigcirc$ +1.75D. cyl. ax. 105°; L.E., +4.5D. $\bigcirc$ +1.25D. cyl. ax. 75°.

A three-mm. recession of the left medial rectus and a seven-mm. resection of the left lateral rectus were performed. Naturally, this amount of surgery was intended to correct the 35$^{\Delta}$ of esotropia for near rather than the 10$^{\Delta}$ of esotropia for distance. Consequently the result was an exotropia of 20$^{\Delta}$ for distance and orthophoria for near with glasses.

The second group includes those cases which we have labelled "variable." There were 20 patients in this category. There are three types of variable cases:

1. Patients who measure esotropia and exotropia at different times.

2. Patients who are intermittently orthophoric and esotropic both for distance and near.

3. Patients who at some times have a small amount of strabismus and at other times a large amount.

These variable cases emphasize the importance of repeated examinations before surgery is contemplated. When the patient has both esotropia and exotropia, the deviation is usually of small degree and he should obviously not be subjected to surgery. When orthophoria is observed along with esotropia, the patient should be treated in a similar manner. Orthoptic training is the preferred therapy for such cases. In many instances such deviations result from psychogenic disturbances which no amount of ocular surgery can cure.

The third type of variable case always has an esotropia although it is greater at certain times than at others. Here surgery may be indicated but the ophthalmologist should proceed with caution and should direct his operative procedure to the correction of the least deviation. A clue to the fact that the ophthalmologist is dealing with this type of case may be obtained from the mother who states that her child's eyes frequently are straight. We have found it useful to have the mother keep a daily record of how the patient's eyes appear to her. In some instances we have been successful in teaching the mother how to use a flashlight and observe the corneal reflexes so that we could place some reliance upon the mother's observations.

Summary

1. Of 230 cases of alternating esotropia, 32 percent apparently began to squint in the first year of life, 21 percent in the second year, and 47 percent after the second year. Only 12.9 percent were true alternators.

2. There are more relatively high hypermetropic individuals among alternators than in an average cross-section of patients, but fewer high hypermetropic individuals than among all cases of esotropia.

3. Of the 230 cases 7.7 percent were accommodative, 39 percent were partially accommodative, and 27.2 percent were nonaccommodative.

4. Equal amounts of recession and resection often give different results, and different types and amounts of surgical intervention may produce identical results.

5. The recession and resection operation is recommended over bilateral recession because it gives greater flexibility, especially if further surgery is necessary.

6. Those patients in whom at least 50 percent of the strabismus is reduced by glasses have a more favorable prognosis than those in whom less than 50 percent of the strabismus is reduced by glasses.

7. In cases where the apparent degree of strabismus is less than the amount measured with the screen and prism test, the surgery should be aimed at reducing that error which is present when the dominant eye is fixing.

8. The near-point of convergence has significance in planning surgery only when it is over 60 mm. (seven out of 122 cases), and resections of the lateral recti are the operations of choice in the presence of a remote near-point of convergence.

9. The role of heredity in planning surgery is stressed.

10. In patients who measure a very small amount of deviation for distance but a much greater amount for near, the surgery should be aimed at correcting the distance deviation; while the residual near deviation should be treated with bifocals and orthoptic training.

11. In variable cases which at times have a small amount of strabismus and at other times a large amount, surgery should be aimed at correcting the smallest deviation.

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DIVERGENT STRABISMUS WITH WEAKNESS OF THE INFERIOR RECTUS MUSCLE*

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At the muscle clinic of the Manhattan Eye, Ear, and Throat Hospital, we have become increasingly impressed with the importance of surgically correcting vertical deviations associated with divergent strabismus. Costenbader[1] has stated that a vertical imbalance occurs more frequently in association with a divergence excess than with any other type of misalignment. White and Brown[2] found that 59.9 percent of their cases with divergence excess had an associated vertical imbalance. Bielschowsky,[3] Pugh,[4] and Enos[5] also found a large proportion of horizontal squints with associated vertical deviations.

We have been particularly interested in patients showing a divergent strabismus with an associated weakness of one or both inferior recti. Our observations have led us to believe that these patients should not only have horizontal surgery done, but should also have resection of one or both inferior recti. We believe that the vertical muscle surgery should be done at the same time as the horizontal surgery.

The primary function of the inferior rectus muscle is depression. There is an important secondary function of adduction, and a third of extorsion. When the eye is fully abducted, the inferior rectus is in the field of its greatest action and is a pure depressor. As it approaches the primary position and out of the field of greatest depressor action, the adduction becomes more and more manifest.[6] Therefore, when there is underaction of the inferior rectus muscle, not only may a hypertropia be manifested but almost all the adduction power may be lost. In a divergent squint in which there is also a weakness of the inferior rectus muscle, whatever adducting power might have been used to maintain an orthophoric position is absent and the divergence actually becomes greater. Strengthening the action of the inferior rectus will add to its adduction power and increase the effect of any horizontal surgery, almost additively.

Most patients who show a divergent squint and a weakness of the inferior rectus, who have had only horizontal surgery, show a final postoperative undercorrection. Fink[7] believes that a functional improvement can almost never be obtained with horizontal surgery alone. We have found that patients with a good result immediately following horizontal surgery alone can be expected to show recurrence of progressively increasing divergence several months later, as this illustrates:

CASE REPORT

J. G., preoperative measurements:
Refraction: O.D., +2.5D. sph. = 20/20; O.S., +3.0D. sph. = 20/30.
Motility: Weakness of right inferior rectus.
Primary position: Distance, XT 35Δ; near, X' 35Δ. No measurable hypertropia.
Right gaze: XT 35Δ (measured at distance).
Left gaze: XT 35Δ (measured at distance).
P.C.B.: 75 mm.
Surgery: Bilateral resection medial recti five mm.
Postoperative Measurements:

Primary position:	*2 months*	*7 months*
Distance	XT 16Δ	XT 25Δ
Near	X' 25Δ	X' 35Δ

Right gaze: XT 30Δ } Measured at distance
Left gaze: XT 30Δ } 15 months postoperatively
P.C.B.: 70 mm.

Recurrence of divergence following horizontal surgery only.

Scobee's[7] comment that many patients could have been saved several operations if the vertical component had only been recognized is only too true. Postoperatively, we have found that some cases may even manifest a definite hypertropia that is not noticed

* Read before New York Academy of Medicine, Section on Ophthalmology, March 15, 1954.

TABLE 1

TWENTY CASES OF DIVERGENT STRABISMUS WITH WEAKNESS OF THE INFERIOR RECTI

Inferior Rectus Operated, Nine Cases			
Residual Exotropia		*Residual Exotropia*	
Orthophoria—15$^{\Delta}$	7	20$^{\Delta}$–30$^{\Delta}$	1
		30$^{\Delta}$–40$^{\Delta}$	1
TOTAL	7 (77%)	TOTAL	2 (23%)

Inferior Rectus not Operated, 11 Cases			
Residual Exotropia		*Residual Exotropia*	
Orthophoria—15$^{\Delta}$	2	25$^{\Delta}$–30$^{\Delta}$	3
		30$^{\Delta}$–40$^{\Delta}$	3
		40$^{\Delta}$–50$^{\Delta}$	2
		Marked hypertropia	1
TOTAL	2 (18%)	TOTAL	9 (82%)

on a casual examination prior to surgery, as this illustrates:

CASE REPORT

M. R., preoperative measurements:

Refraction: O.D., +1.5D. sph. ⊃ +0.75D. cyl. ax. 90° = 20/30; O.S., +1.75D. sph. ⊃ +0.25D. cyl. ax. 90° = 20/30.

Motility: Weakness of inferior recti, O.U.

Primary position: Distance, XT 10$^{\Delta}$ (not measured at 6 M. or beyond); Near XT' 24$^{\Delta}$. No measurable hypertropia.

P.C.B.: 95 mm.

Surgery: Bilateral resection medial recti five mm.

Postoperative measurements:

Primary position: Near, X' 9$^{\Delta}$ (RH 14$^{\Delta}$ LH 10$^{\Delta}$).

P.C.B.: 80 mm.

Horizontal surgery alone resulting in bilateral hypertropia.

For this reason we have found it desirable to measure cardinal fields at a distance of six meters or more in order to bring out any hypertropia that may be masked at 33.3 cm.

Costenbader[1] has also found the vertical deviation greater at distance. Our method is to have the patient fix on an object outside the window of the examining room and tilt his head so that the deviation is measurable in each of the cardinal fields.

Both Fink[7] and Urist[8] feel that patients with a horizontal squint associated with a vertical deviation should have the horizontal squint corrected first. Bielschowsky[9] recommended operating the greater deviation first. We have found no evidence to show that doing the horizontal and vertical muscle surgery at different times is in any way more effective or satisfactory than doing them at the same time. We attribute this to the fact that, with the addition of the adduction power of the inferior recti to that of the horizontal muscles, orthophoria is more easily obtained.

At this hospital we have used the usual technique of muscle resection, and have resected as much as six mm. of the inferior rectus with no untoward effect. Fink[7] believes, however, that no more than five mm. should be done.

An analysis of 20 unselected cases of exotropia (table 1) with weakness of the inferior recti, showed the following results (the criterion of a good result was a follow-up measurement of orthophoria to 15 diopters of residual exotropia):

In the group in which both horizontal surgery and resection of the inferior rectus were done, a good result was obtained in 77 percent of cases. In the group in which only horizontal surgery was done a good result was obtained in 18 percent of cases.

CASE REPORTS

B. L., Preoperative Measurements:

Refraction: Emmetropia, O.U.

Motility: Weakness of inferior recti, O.U.

Primary position: Distance, XT 55$^{\Delta}$; Near, XT 50$^{\Delta}$.

Right gaze: XT 60$^{\Delta}$ RH 6$^{\Delta}$ (measured at distance).

Left gaze: XT 50$^{\Delta}$ LH 8$^{\Delta}$ (measured at distance).

P.C.B.: 250 mm.

Surgery: Bilateral resection medial recti four mm.

Postoperative Measurements:

Primary position: Distance, XT 55$^{\Delta}$; Near, XT' 50$^{\Delta}$.

P.C.B.: Remote.

Motility: Marked weakness of inferior recti, O.U.

Horizontal surgery alone resulting in undercorrection.

M. F., Preoperative Measurements:

Refraction: O.D., −0.5D. sph. ⊃ −0.5D. cyl. ax. 180°; O.S., plano.

Motility: Weakness of inferior recti, O.U.

Primary position: Distance, XT 28$^{\Delta}$ RH 7$^{\Delta}$; Near, X' 12$^{\Delta}$.

Right upper gaze: XT 14Δ, right lateral gaze: XT 12Δ RH 14Δ, right lower gaze: XT 21Δ RH 20Δ (⅓ M.).

Left upper gaze: X 12Δ, left lateral gaze: X 14Δ, left lower gaze: XT 16Δ LH 8Δ (⅓ M.).

Right gaze: XT 22Δ RH 18Δ (beyond 6 M.).

Left gaze: XT Δ 20 LH 5Δ (beyond 6 M.).

Surgery: Recession right lateral rectus five mm.; resection right inferior rectus, six mm.

Postoperative measurements:

Primary position: Distance X 8Δ; Near X' 2Δ.

Right gaze: Orthophoria

Left gaze: Orthophoria

P.C.B.: 50 mm.

Resection of inferior rectus resulting in small residual exophoria.

B. S., Preoperative Measurements:

Refraction: O.D., +0.5D. sph ⊃ +0.25D. cyl. ax. 75° = 20/25; O.S., +0.75D. sph. ⊃ +0.25D. cyl. ax. 90° = 20/25.

Motility: Weakness of right inferior rectus.

Primary position: Distance, XT 30Δ RH 7Δ; Near, X' 10Δ.

Right gaze: XT 22Δ RH 5Δ (measured at 6 M.—always a tropia).

Left gaze: XT 25Δ (measured at 6 M.—always a tropia).

P.C.B.: 55 mm.

Surgery: Recession right lateral rectus five mm.; resection right inferior rectus four mm.

Postoperative measurements:

Primary position: Distance, X 24Δ; Near, X' 10Δ.

P.C.B.: Unchanged.

Resection of inferior rectus resulting in residual exophoria.

Many cases showing divergent squint with weakness of the inferior recti could not be used in this series because no surgery had been performed. Their large number would seem to indicate that the importance of operating these cases is not sufficiently recognized.

Summary

Twenty cases of divergent strabismus with weakness of the inferior recti are presented.

Patients with divergent strabismus should be examined beyond six meters to bring out any vertical component.

In divergent strabismus with associated weakness of the inferior recti, inferior rectus resection, as well as horizontal surgery, should be done.

Vertical and horizontal surgery should be done at the same time.

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NEW THEORIES OF VASCULAR DISEASE*

With special reference to the syndrome of polycythemia in ocular pathology

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Introduction

In this paper, I should like to discuss the syndrome of polycythemia or "sludging" of the blood and give it its rightful place as an unrecognized cause of many vascular complications, especially thrombo-embolism, both in ophthalmology and medicine as a whole.

Polycythemia has long been recognized, usually by the ophthalmologist, as a cause of retinal hemorrhage, but the syndrome of polycythemia, including not only the rare polycythemia vera but also the common secondary types, has yet to be placed in the important position it deserves as a cause of many vascular problems. When considered as a counterpart of anemia, including "chronic shock," it is as important a vascular problem as any now recognized.

Vascular accidents following surgery, as well as in unoperated individuals, occur more frequently in the fifth decade, the age at which the polycythemic syndrome becomes most frequent. This relationship alone makes it important to keep polycythemia in mind when considering preventive measures against vascular accidents.

In the prevention of vascular accidents and hemorrhage, little can be done about the atheroscleroses, the arteriolar spasms of hypertension, or the stresses and strains of life, but one factor that can easily be removed is the excess volume of circulating blood. With the increased use of the accurate diagnostic test, the blood-volume test, much can be done to remove strain from the "middle-aged" vascular tree.

Since the hematocrit is widely used as part of the complete blood count, all surgeons should consider the hematocrit as one method of diagnosing excessive blood volume when the blood-volume test is not available. However, the inaccuracies of the hematocrit have been demonstrated on both sides of the normal blood volume (Barbour, Clark, et al.) so, when a question arises, one should investigate beyond the hematocrit or the hemoglobin.

Hemorrhage, in eye surgery especially, when not due to trauma, most often results from placing extreme strain on weakened vessels. Many ocular hemorrhages can be avoided by normalizing blood volume. Many vascular accidents can be prevented by learning to recognize the syndrome of polycythemia in office practice.

Although the incidence of polycythemia vera is uncommon, the occurrence of relative polycythemic states is common. Rarely, in eye surgery in this well-nourished land of ours, does a surgical schedule contain no cases of the syndrome. In my experience, operating days with two to six cases always bring up at least one case that will show the polycythemia syndrome, often more.

If this syndrome is not recognized before surgery, complications—easy hemorrhage, hyphema, thrombosis, or anesthesia difficulty—are likely to ensue. I have found it worth while to check on this syndrome before the day of operation, thus giving time to normalize blood volume without upsetting the operating schedule.

Although the incidence of polycythemia varies with the economic and social level of the patient, the incidence of excessive blood volume with its attendant complications is much higher than generally recognized. Polycythemia occurs more often in males between 50 to 60 years of age, and far more often in private than in clinic practice.

* Presented before the Virginia Society of Ophthalmology and Otolaryngology, Richmond, Virginia, December, 1953.

TABLE 1

INCIDENCE OF POLYCYTHEMIA IN 10 CONSECUTIVE CASES OF THROMBOSIS AFFECTING THE VISUAL ORGANS, RETINA, AND BRAIN

Case and Age (yr.)	Eye Diagnosis	Hematocrit (percent)	Total Blood Volume	RBC Volume	Blood Pressure (mm. Hg)	neral Diagnosis	Vision
1. C. M. 50	Branch venous thrombosis, retina	56	Excess 1,750 cc.	Excess 1,610 cc.	210/110	Diabetes, polycythemia, overweight	Improved to 20/25
2. H. R. 53	Central venous thrombosis, retina	50	Normal	Excess 500 cc.	130/98	Polycythemia, dental caries, diabetes	Not improved
3. P. J. B. 43	Branch venous thrombosis, retina	39	Deficit 850 cc.	Deficit 1,200 cc.	118/76	Traumatic thrombosis	Improved to 20/20
4. P. J. 49	Right hyperphoria 10 prism diopters		Excess	Excess 614 cc.		Cerebral venous thrombosis polycythemia	Improved
5. S. C. 59	Central venous thrombosis	53	Excess	Excess	105/65	Diabetes, polycythemia	Improved to 20/20
6. L. S. 60	Central venous thrombosis, retina	45	Excess		180/90	Hypertensive arteriosclerotic cardiovascular disease, polycythemia	Not improved
7. M. S. 74	Central venous thrombosis		Excess		180/90	Hypertension, arteriosclerosis, polycythemia	Not improved
8. M. M. 68	Branch venous thrombosis, retina	45	Excess 664 cc.	Excess 468 cc.	200/104	Polycythemia, hypertension, arteriosclerosis	Improved to 20/50
9. T. N. 54	Homonymous hemianopsia	48	Borderline		110/80	Prostatectomy cerebral thrombosis, polycythemia	Not improved
10. E. R. 50	Cataracts	53	Excess 492 cc.	Excess 680 cc.	154/80	Femoral vein thrombosis cataracts, polycythemia, overweight	Improved to 20/20

Racially, it is more common in English, Americans, and Italians, subject to economic variations. Retired executives often have it.

Certain specialties seem to see it more frequently than others. Ophthalmologists (table 1) note it frequently; otolaryngologists rarely see it.

The polycythemia syndrome occurs in families. I know one family—mother, daughter, and father—all with excessive blood volumes, the mother with retinal thrombosis.

Excess of blood volume leads to hemorrhage and thrombosis, while deficiencies lead to shock. The complications that may occur in cataract surgery when excesses in blood volume are not adjusted are:

1. Thrombosis of the coronary, cerebral, pulmonary, and ophthalmic veins.

2. Hemorrhages—expulsive choroidal, hyphema, and annoying hemorrhage at the time of surgery.

3. In diabetes—hemorrhagic tendencies must be carefully controlled.

SURGICAL COMPLICATIONS DUE TO BLOOD-VOLUME ABNORMALITIES

Abnormalities in the patient's blood volume and their attendant vascular complications, if unrecognized before surgery, may cause the loss of an eye or even the loss of the patient. Successful intraocular surgery requires their recognition and their proper handling.

Anesthesia, whether local or general, has direct effects on the vascular tree.

In *local anesthesia*, the patients are subject to the adrenergic effects of fear and, often, pain. If they are hypertensive, as well as polycythemic, sudden increases in blood pressure bring the risk of vascular rupture and add the danger of prolonged or repeated hemorrhage from cut vessels. In this type of patient, the use of local adrenalin to control hemorrhage adds a further danger which can be avoided by removing the polycythemic factor before operation.

In *general anesthesia*, where the blood pressure is maximally reduced by pentothal, these dangers may be lessened. However, there are other dangers attendant upon administration of pentothal to polycythemics, the foremost of which is the tendency of polycythemics not to oxygenate themselves properly. Even when high concentrations of oxygen are administered, these patients take pentothal poorly, thus endangering not only their eyes but themselves.

Anesthetic deaths on the operating table,

even before surgery begins, have been attributed to the polycythemia syndrome.

Blood-volume studies

Many ophthalmic surgeons are not aware of the importance of blood-volume studies. It is hoped that the following case studies and comments will illustrate some measure of their importance.

Case 1. E. R., aged 66 years, had not been able to see well for one and a half years because of a cataract on his right eye. He had previously been operated upon for a prostate and bilateral hernia and, before cataract surgery, he was examined by an internist who reported that the patient seemed to be in good health and should stand the operation well. He reported hemoglobin at 111 percent and stated that this patient's hemoglobin had always been high but that neither polycythemia nor endarteritis obliterans had been diagnosed, although there had been complaint of swelling of the calves of the legs after walking. In the internist's opinion this was not Buerger's disease.

The patient was admitted for cataract extraction and, since general anesthesia was to be used, his blood volume was checked—routine in all of my preoperative cases. Blood-volume studies showed an excess of 1,445 cc. of RBC, that is, three too many units of blood (a unit being 500 cc.). One pint of blood was withdrawn on the same day and another pint the next day; however, surgery had to be postponed, upsetting the operating schedule because it takes another 24 hours, and sometimes 48 hours, for the ratio of blood cells and blood serum to be normalized after phlebotomy.

The patient wanted to know why blood was withdrawn, and it was explained to him that persons who had thick blood, or "sludge," as it is sometimes called, in their veins are more likely to have thrombosis and bleeding than are persons with normal free-flowing blood. This patient felt much better after removal of three pints of blood and the operation proceeded uneventfully.

If there is concern that patients may suffer thrombosis in various important organs during surgical and convalescent care, one of the most important factors to be considered is the blood volume. Polycythemia, whether it is relative, local, or true, is a frequent cause of venous thrombosis, as well as undesirable hemorrhage. Two things were learned from Case 1:

1. When the conjunctival flap was dissected, this patient had more than the usual bleeding. Even though his hematocrit was reduced to 40 percent by phlebotomy, the tendency of his small vessels to bleed remained. How much worse the hemorrhage would have been if he had been operated when his hematocrit was 55 percent!

2. This case showed that the hemoglobin estimation is not sufficient to judge the preoperative blood picture of a patient. In this case, the diagnosis of polycythemia was overlooked by the internist. The hematocrit does not always give the correct state of the blood volume, as the following case shows:

Case 2. Mrs. H. W., a 55-year-old woman, overweight and with long-standing diabetes, was to be admitted for cataract surgery. She was prepared in the office of her physician and entered the hospital in good diabetic control.

It was thought that she was in good shape for surgery since her hematocrit was only 45 percent or one point above the arbitrary normal for females. However, the blood volume showed:

Total plasma protein, 4.49 gm./K. (excess, 103.5 gm.); plasma volume, 54.5 cc./K. (excess, 950 cc.); RBC volume, 44.6 cc./K. (excess, 1,080 cc.); total blood volume, 99.5 cc./K. (excess, 2,030 cc.). Hematocrit, 45 percent; plasma protein, 8.2; weight, 65 K. *Conclusions:* Excess four units whole blood based on expected weight of 142 lb.

This patient had previously had phlebitis of the left leg and there was concern over another thrombosis. As may be seen from the report, she showed an excess of 2,030 cc. total blood volume. Phlebotomy was performed and her blood volume was reduced to normal. She went through the operation uneventfully and was discharged with an excellent result.

The increasing use of general anesthesia in ocular surgery makes it more important than ever to assess properly the patient from the standpoint of his general fitness for surgery. Formerly, operating without the help of a team of medical, laboratory, and anesthesia specialists, the ophthalmic surgeon discovered too late that some physical defect in his patient accounted for a poor result after his successfully performed cataract extraction.

Geriatric problems

The increasing age of surgical patients, a direct result of the increased longevity of this era, makes consideration of geriatric problems paramount in present-day surgery.

TABLE 2

COMPARISON OF MORTALITY IN TWO SERIES WITH AND WITHOUT BLOOD-VOLUME STUDIES AND REPLETION*

	Cases	Deaths	Percent
No blood volume	190	33	17.4
With blood volume	100	8	8.0
Difference			9.4
Standard error of difference			3.86

* From Beling, C. A., Bosch, D. T., and Carter, O. B., Jr.: Blood volume in geriatric surgery. Geriatrics, 7: (May–June) 1952.

More extensive surgery (Birge) makes such consideration even more essential.

Table 2 presents a graphic illustration of the decrease in mortality in elderly patients in whom blood-volume studies were done. Although Table 2 is taken from a paper which deals primarily with deficits in blood volume, I am convinced that excesses in blood volume are even more important in ophthalmic surgery, and their correction will bring equal or better results.

Many complications that may occur on the operating table could be avoided by properly adjusting the blood volume before surgery. However, the same complications may occur during the convalescent period. The patient who has cerebral thrombosis shortly after returning home may not be listed in the hospital record but the surgeon and the family know that the stroke occurred as a complication of the operation.

The importance of blood-volume studies before cataract surgery has been so apparent in my cases that I feel that a blood-volume estimation should be routine in all cases in which a hematocrit report shows any abnormality whatsoever. I use, arbitrarily, an hematocrit level of 40 to 44 percent in the female and 44 to 48 percent in the male.

CARDIAC PATIENTS

Ocular surgery in cardiac patients is not infrequent. At least four types of heart disease—(1) hypertensive cardiovascular disease, (2) after coronary thrombosis, (3) sclerotic cardiac problems, and (4) congenital heart disease—and often others, make ocular surgery more of a problem in those so afflicted than in healthy patients. The results in a few cases of ocular surgery in cardiac patients are briefly reported:

Case 3. Mr. W. E., aged 71 years, had lost vision in his right eye 10 years previously after what he said was a heart spasm. I concluded that this was a venous thrombosis in his right eye. He had been suffering from failure of vision in his left eye for three months before coming to my office.

Examination revealed that there was no light perception in the right eye and that tension varied between 40 and 56 mm. Hg (Schiøtz). The tension in his left eye was 48 mm. Hg on admission to the office and he had a typical advanced glaucoma with central scotoma and vision of 20/80 or less.

The tension in his left eye was controlled with four-percent pilocarpine every three hours. It was impossible to control the tension in his blind right eye with any medication. The pain became severe and, because his cardiac condition caused concern, it seemed best that he should not suffer pain. Enucleation was finally decided upon two months after his first visit.

When he was admitted to the hospital, tension in the right eye was over 75 mm. Hg. Examination revealed the following cardiac problems: (1) Ventricular premature contractions, (2) severe left-axis deviation, and (3) old posterior miocardial infarction. In addition, his hematocrit was 54 percent; NPN, 61, and he showed two-plus albumin in the urine.

Blood-volume determination showed that this patient had an excess of 1,500 cc. After consultation, it was decided that he would do better if blood were withdrawn. A mild attack of syncope occurred after the second phlebotomy. However, operation was performed and the patient made an uneventful recovery and was discharged in five days.

After he arrived home, he had a chest complication which was considered to be a small embolus but he recovered from this and visited the office several times for the control of the glaucoma in his left eye and follow-up on the healing of his right eye.

The patient made good progress and, when last seen in September, vision in his left eye was 20/70. No more was heard from him until a month later when it was learned that he had had a second coronary thrombosis and died.

The following case illustrates the difficulty of handling elderly persons who have had cardiac disease.

Case 4. Mr. W. F. D., aged 57 years, a busy executive, was referred because his distance vision was not as good as it should be. He was dizzy and had noted some blurring of vision when he became excited. He had recently retired because of a mild heart attack. Referral was by a hematologist.

The office diagnosis, based upon a two-diopter right hyperphoria, was that, in addition to having polycythemia, he had also suffered a slight cerebral accident. His retinal arteries revealed extensive evidence of hypertension and sclerosis. The sclerosis was excessive in that there were numerous ruby-colored lesions in the arteries. There was also evidence of scattered retinal hemorrhages. After consultation with the hematologist concerning the recent cerebral vascular accident, the polycythemia was controlled by the use of P_{32}.

Prisms were prescribed and the patient was able to resume driving his car and, in general, improved sufficiently to go back to his office for half days.

When last seen, his vision was improving. The hyperphoria remained the same; however, the P_{32} had not taken care of the polycythemia very well, and the patient had to be treated by three phlebotomies in order to minimize the danger of further episodes of thrombo-embolism.

This case illustrates how typical small cerebral vascular accidents bring about vertical phorias which can be diagnosed in the ophthalmologist's office. These may occur in some cases which are not sent to the ophthalmologist by the hematologist. It may be the ophthalmologist who diagnoses the polycythemia syndrome.

Case 5. Miss L. S., aged 20 years, came to the office because of a cosmetic defect. She was suffering from divergent strabismus which measured 35 to 40 degrees. She had suffered from congenital heart disease since birth and had recently been investigated for possible cardiac surgery. Her diagnosis, Isenmenger complex, had been confirmed by cardiac catheterization. The cardiologist felt that a heart operation would not benefit her.

She felt that she would get a great deal of benefit from having her eyes straightened. She realized the increased danger because of her heart disease but, nevertheless, elected to have the operation.

On entrance to the hospital, it was found that she had a hematocrit of 66 percent with excessive blood volume. The hematocrit was elevated in compensation for her poor oxygen saturation which was only 76 percent. In this case, the operation was postponed for consultation with several cardiologists. It was finally determined that a phlebotomy should be done. This case offers considerable possibility for discussion of all branches of medicine.

The operation was performed on both eyes and proceeded uneventfully. The patient was satisfied with the results.

By recognizing and treating the syndrome of polycythemia, one controls not only the tendency of thick blood to clot but one also removes the strain on the weakened sclerotic vessels (especially the veins) which occurs when there is elevated blood pressure accompanied by an additional quantity of blood in the circulatory system.

Thrombo-embolism

Why should thrombo-embolism be more common in the polycythemia syndrome?

First, there is evidence in proven autopsy records that 56 percent of persons with polycythemia vera die from thrombo-embolism or hemorrhage. Thrombosis caused 37.5 percent of the deaths, while hemorrhage caused 18.8 percent. Thrombosis is, therefore, twice as common as hemorrhage as the cause of death.

In the second place, the polycythemic person has more platelets, more blood cells, more fibrin than the normal individual. Often there is thick blue, rapidly clotting blood in the syringe of the technician during testing for polycythemia. If blood clots quickly in the test tube, it certainly will in the patient. These factors are demonstrated in the bleeding and clotting tests, and the prothrombin tests. An increase in all the clotting elements is present with any quantitative increase in blood.

Third, retinal venous thrombosis occurring in patients beyond middle life may often be attributed to an excess of red blood cells or a mild form of polycythemia. Since I have been checking the blood volume in my cases, I have found that low grades of polycythemia are frequently associated with retinal venous thrombosis. I have had 22 such cases.

It is logical to suppose that retarding of the blood flow through the smaller vessels of the retina may predispose to thrombosis. In cases in which only one branch of the central retinal vein is affected, the outcome has been satisfactory in that the vision has returned to normal following a reduction of the polycythemia to normal. When massive thrombosis takes place in the retina, the outcome is never satisfactory. Complications such as diabetes adversely affect the outcome. Cases in which blood-volume studies

TABLE 3

POSSIBLE ETIOLOGIC FACTORS IN RETINAL VENOUS THROMBOSIS

Infection (direct or focal)
Neoplasm
Surgery (rare)
Cardiac decompensation
Trauma
Arteriosclerosis
Diabetes
Hypertension
Glaucoma
Polycythemia

should be performed are those in which the retinal veins are enlarged, engorged, and slightly cyanotic.

Recent articles have suggested that the prognosis for life after a retinal venous thrombosis is only five to eight years (Moore). This prognosis may be modified if the cause of thrombosis is removed.

Since the retina is easily visualized, it may be used to demonstrate the possible causes of thrombosis (table 3). In addition to the etiologic factors listed in Table 3 it is probable that one of the primary causes of retinal thrombosis, and one long unrecognized, has been the polycythemia syndrome, which causes stasis, together with ease of clotting, especially in the smaller vessels of the body.

Sclerosis, diabetes, and nervous tension increase the incidence of thrombosis because of the vascular damage associated with these conditions but the polycythemia syndrome is often the basic cause of clot formation. Because the polycythemia syndrome may be diagnosed from the retinal venous picture, I would like to show a table of grading of vascular disease in the retina (table 4). This table shows the diagnostic possibilities that are apparent when the retinal veins, as well as the arteries, are studied ophthalmoscopically.

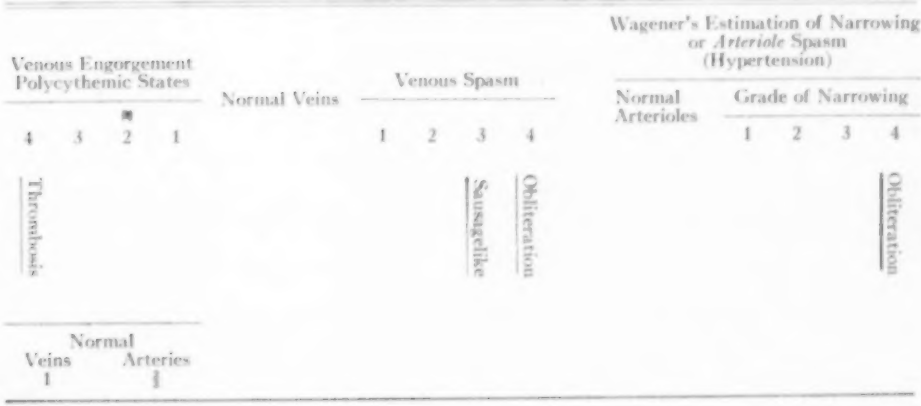
TREATMENT OF THE POLYCYTHEMIA SYNDROME

When treatment for the polycythemia syndrome must be administered quickly, phlebotomy is the method of choice. This procedure may be used for long-term treatment if it is repeated at the required intervals.

Treatment of the syndrome by the use of radioactive phosphorous (P_{32}) is preferred by hematologists in cases of polycythemia vera. Complications in the use of P_{32} have been thoroughly covered by Jacobson and others. There is a theoretical reason why treatment with P_{32} should be more effective than phlebotomy, when there is sufficient time for the drug to take effect—the red cells formed during treatment with

TABLE 4

OPHTHALMOSCOPIC GRADING OF VASCULAR DISEASE



P_{32} are more normal than those which remain after phlebotomy.

The problems which arise in using anticoagulant therapy are many and frequently so acute that other serious problems, such as sclerosis, hypertension, cardiac weakness, or diabetes are therapeutically disregarded.

There are two anticoagulant drugs to decrease agglutination or adhesiveness of the platelets—Heparin, an expensive drug for intravenous or intramuscular use, and the less expensive coumarin derivatives which are used orally. The expense of the control of prothrombin time necessary with the coumarin derivatives increases the cost of the latter therapy, however.

The only case in which I used anticoagulants in the past few years was that of a young man who developed bilateral venous thrombosis subsequent to extraction of infected teeth. He received intravenous procaine, antibiotics, and small doses of anticoagulants, with return of vision to 20/50 in one eye. He had no polycythemia.

I do not, however, favor anticoagulant therapy but suggest more frequent study of the blood volume, with changes in the blood elements as indicated. This therapy seems to give better results with less danger and at less expense than anticoagulant therapy. By reducing the excessive blood volume, the problem can be handled simply in the office, and proper attention can be given to such secondary factors as hypertension, diabetes, or cardiac failure.

Case 8. M. M., a 68-year-old woman, had a retinal thrombosis with return of vision to 20/50 in two months. After six months, the vision returned to 20/20. A year later, the patient suffered another thrombosis. This time, phlebotomy was performed but, since the eye had suffered a second thrombosis, I had little hope of improving vision. However, within six months the vision was again restored to 20/20.

A careful watch on the blood volume was maintained and, with phlebotomies every three months, no further thrombosis occurred. Both her physician and I have become believers in the importance of recognizing and treating the polycythemia syndrome. To my knowledge, no other case of repeated retinal thrombosis has ever been reported three years later as having good vision, under any form of therapy.

Comment

Thrombosis is so common in polycythemics that, when the ophthalmologist sees engorged, cyanotic retinal veins, he is justified in obtaining an hematocrit and, if the values are above 44 in females or 47 in males, he should order a blood-volume determination. This practice will not only prevent many vascular accidents, but, when used for the therapy of thrombo-embolism, will reduce the cost and complications and still produce results that compare favorably with other forms of treatment. When middle-aged persons have polycythemia due to excesses in diet, the simplest form of treatment is, of course, the proper diet.

Summary

The importance of polycythemia states in relation to vascular diseases, especially in surgical patients, has been emphasized.

Recognition of the polycythemia syndrome by means of blood-volume determination offers surgeons a diagnostic and therapeutic weapon to prevent vascular complications.

664 Farmington Avenue (5).

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A NEW VISUAL SCREENING TEST FOR SCHOOL CHILDREN

A PRELIMINARY TEST OF 799 SCHOOL CHILDREN

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The recent organized assault against inadequate visual screening programs in schools demands that ophthalmologists propose an answer to this ever-growing problem.

To meet this problem, as consultant oculist to the Atlantic City public schools, I developed the Atlantic City Eye Test. It has been used there effectively since 1952.

Although no apologies are necessary to defend the proper use of Snellen test type in visual screening, it has become increasingly obvious that tests for visual acuity alone cannot constitute an acceptable visual screening program. The St. Louis Study[1] showed that the newer screening devices, when testing for more than visual acuity, increased the number of unnecessary eye referrals far more than it increased the number of students properly referred. High false referral rates undermine the effectivity of a screening device, and cause friction between parents and the school. Yet, tests for more than simple visual acuity must be done because of the definite demonstrable relationship between a student's visual skills and the performance of his school work.[2]

The important visual functions adaptable to a screening program were considered and (1) visual acuity, (2) manifest hyperopia, and (3) eye muscle balance were chosen as those most important to a school child. The incidence of abnormal accommodation, vergences, fusion power, stereopsis, and so forth in the presence of a normal visual acuity, emmetropia, and orthophoria is too infrequent to justify routine testing for these functions.[3]

To popularize a visual screening test certain criteria must be attained. The test must be: (1) Accurate, (2) quick, (3) simple, (4) easily administered, (5) inexpensive, (6) easily recorded, (7) interesting to the child, and (8) capable of detecting who should have an eye examination.

The stereoscopic and polaroid instruments presently in use, such as the Ortho-Rater, Telebinocular, and Sight Screener seem unsuited for school screening, because of an unnecessarily high false referral rate, a lack of simple application, excessive time consumption, relatively high cost,[4] and particularly for their failure to test for excessive manifest hyperopia, which we consider an important visual defect in a school child.

The Massachusetts Eye Test, which screens for the same information obtained by the test here presented, falsely refers too many children because of the leniency of its

test for manifest hyperopia and employs a muscle testing device which is time-consuming and difficult to administer, particularly to the younger students.[4, 5]

The Atlantic City eye muscle test, on the other hand, is a simple, accurate, and almost instantaneous method of detecting abnormal eye muscle balance, and constitutes a major improvement over other screening devices.

Much has been said about visual acuity and manifest hyperopia. I shall confine most of this paper to the discussion of our eye muscle test for ocular deviations.

The test

Each child was tested first for visual acuity, next for manifest hyperopia, and finally for eye muscle balance.

Visual acuity

The visual acuity of the child was determined by the use of Snellen test letters for the literate, and Snellen E letters for the illiterate. These subtend a five-minute visual angle for form, with component parts of one minute. The testing distance was 20 feet. The illumination was at least 20 foot-candles of reflected light at any point on the chart. This complies with the standards set by the Section on Ophthalmology of the American Medical Association.[6]

Inability to read most of the 20/20 line constituted a failure, that is, a school child, nine or more years of age, with a visual acuity of 20/25 or less, should be advised to have an eye examination. Children in the first three grades of school (under the age of nine) should have 20/30 vision, that is, a visual acuity of 20/40 should require an eye examination.[4, 7, 8]

It was found that older children could be screened with greater ease using the Snellen alphabet letters, while younger children did best with the illiterate E letters.

The conventional letter chart which simultaneously exposes the letter sizes from 20/20 to 20/200, while useful in an office model of our test, had disadvantages in school vision testing. Actually, visual screening in schools should only attempt to separate the normal from the abnormal and determine who needs an eye examination.

A visual acuity of less than 20/30 is of diagnostic value only, in so far as a screening test is concerned, because all children with less than 20/30 vision should have a competent eye examination. Therefore only the letters ranging in sizes from 20/20 to 20/30 are important for screening purposes.

Limiting the exposure of letters to these lines has several advantages. It directs the child's attention immediately to the lines in question, simplifies the directions in conducting the test, and makes the testing apparatus more compact, and thus easier to handle or carry (fig. 1).

Three testing cards were made, one displayed the 20/20, 20/25 and 20/30 lines of the Snellen alphabet. The second, the same sized illiterate E lines. The third card extended the illiterate E series to 20/200, so that when special circumstances required, visions less than 20/30 could be recorded.

Of the 799 seventh and eighth grade childern, 143 (18 percent) failed this visual acuity test.

Excessive manifest hyperopia

To meet the need for increasing the stringency of the manifest hyperopia test, we used spectacles with plus 1.75 D. sph., and failed those who could read the 20/20 line while wearing these glasses. This produced a failure rate of 2.4 percent or 19 of the 799 students tested. Fifteen of these children were examined by me. Five had hyperopia of one diopter or less but passed the manifest hyperopia test when rescreened. Ten had more than two diopters of hyperopia, and six of these 10 had considerable astigmatism. Seven of these 10 had symptoms of asthenopia.

Several authors have reported studies of the plus-sphere test for manifest hyperopia, and also recommend the plus 1.75 D. sph.

test with the ability to read the 20/20 line constituting a failure.[4, 5] Although the plus 1.75 D. sph. test is practicable for the older age group, more plus sphere may be needed when we screen the first three grades of school children. Further study is necessary to establish this with certainty.

Eye muscle testing

Discussion. The truly normal position of the eyes at rest is probably unknown, because all phoria tests present artificial conditions as the modus operandi of the test. Phoria tests may yield different measurements of heterophoria depending upon the degree of excitation or depression of the fusional stimuli produced by the test. Basically, all phoria tests attempt to disassociate the visual functions of the two eyes. This visual disassociation can be produced by the use of a stereoscope, polarized light, the cover test, prisms, and so forth, or by the use of colored lights.

The latter is the basis of this test. The red and green colors were found most adaptable. We employed a red and a green colored, heavy plastic; which when superimposed one upon the other transmitted no light.

Spectacles with a red glass for the right eye and a green glass for the left eye were worn by the student. A chart with an illuminated green rectangle was placed at 20 feet from the child (fig.1). Under these conditions the right eye sees only the red dot, the left eye only the green rectangle.

Each division in the upper green line of the rectangle represents two prism diopters of lateral phoria. The red dot is so situated in the green rectangle that if it were moved more than six cm. up or down, it would be above or below the green rectangle. Since six cm. represents the effect of one prism diopter at 20 feet, the child with more than one prism diopter of hyperphoria will see the red dot above or below the green rectangle, while wearing the red-green glasses.

Similarly the test will place the red dot outside the rectangle if there are more than four prism diopters of exophoria or more than six prism diopters of esophoria. Therefore, the child is simply asked: "Is the red dot in or out of the green rectangle?"

If the dot appears within or touching any part of the green rectangle, the phoria is within the prism diopter limits specified. If the dot appears outside the rectangle, the phoria exceeds the limits specified and the child has failed the test. Thus the test detects lateral and vertical imbalances simultaneously and almost instantaneously. Readings were constant and did not excite convergence as did the Maddox-rod test.

Discussion of standards used. The power

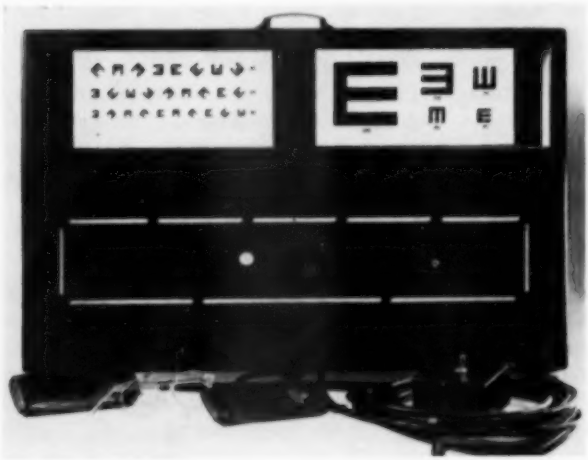

Fig. 1 (Diskan). The Atlantic City Eye Test, showing the upper panel with properly illuminated Snellen test type for measuring visual acuity and manifest hyperopia. The lower panel contains the red dot and the green rectangle used in the ocular deviation test. The two-way switch controls the lighting. The handle makes the equipment easily portable.

of fusion determines how much heterophoria the individual can tolerate with comfort, and probably accounts for the wide variety of normals that appear in the literature pertaining to phorias.

We believe, as many do, that a hyperphoria greater than one prism diopter certainly warrants an eye muscle analysis. Whether corrective measures are needed varies with the history, the findings, and with the standards of the examining ophthalmologist. Many consider a hyperphoria of one and one-half prism diopters within the limits of normal comfortable vision.[7]

The amount of lateral phoria considered normal is subject to an even greater variation of opinions, but the majority of ophthalmologists consider a lateral phoria of five prism diopters, more or less, as within the range of normal function and comfortable vision.[7]

Excessive exophoria at distance generally is a greater barrier to comfortable vision than esophoria; because of the constant relationship normally existing between accommodation and convergence.[9] We, therefore, set our standards to fail an esophoria greater than six prism diopters and an exophoria greater than four prism diopters, at 20 feet.

These standards did not fail excessive numbers and were found to be practicable for screening purposes.

Fourteen or 1.4 percent of the children failed this muscle test. Three of these children had excessive hyperphoria; four, excessive esophoria; and four, excessive exophoria. Three were not available for examination. Four of the children had asthenopia.

A similar device for testing eye muscle balance at 14 inches was also used. The green rectangle outlined distances equivalent to one prism diopter up and down, eight prism diopters of exophoria and one prism diopter of esophoria. The test was used upon 458 children, as Part IV of the examination.

Three children who passed the visual actuity, latent hyperopia, and the muscle test for far, failed this near test. Whereas, the distant phoria test gave constant results, the test for near required considerable time, and caused consternation; because when fixation was changed from far to near, the red dot always started outside the green block and fluctuated considerably before settling within the confines of the block.

Since the near muscle test added little to the over-all picture, we felt that it would not be used routinely in future screening tests. It is the opinion of many ophthalmologists that the near tests are too inconsistent to be of value in a visual screening program in schools.[8]

Testing Time

The average time for screening each child in the first group of 458 children, whose screening test included near as well as far muscle balance, was 70 seconds. In the second group of 341 students tested, the near muscle test was eliminated. The average time per test in this group was 50 seconds. This compares with an average time of 2.4 minutes per examination required to screen a child by the Massachusetts Test,[1] which in turn is much faster than the Telebinocular, Sight-Screener, or Ortho-Rater.

This time saving is attributed to the simplicity of our muscle test. This same simplicity makes the test applicable for visual screening of even the preschool aged child. I have had little difficulty in using the test upon four- and five-year-old children.

Patients who had considerable difficulty with supression when tested with the Maddox rod, had little difficulty with the red-green test. As expected, the test was found effective upon the red-green color defective patient.

Conditions of Testing

All testing was done by the school nurse who had no special eye training. The chart is best placed against a blank wall. As with the Maddox-rod examination, no source of light or reflecting surface should lie in the field of vision of the examined child. Such light

could stimulate fusion. The red plastic used in our test is quite dense and allows the examiner to have a dim light, beside or behind the patient, for general illumination and for recording results. General illumination should be reduced to the point where the red dot appears to move freely in space, indicating that visual disassociation has taken place.

The nurse was given the following instructions:

1. Illuminate the Snellen letters and record the visual acuity (the ability to see the letters) of each eye. The normal eye sees the bottom line (marked 20).

Failure. Children in the first three grades should see the 30 line. Beyond grade three the child should see the 20 line. Inability to see this constitutes a failure.

2. Place the far-sighted (clear) glasses on the patient. Normally this will blur the vision so that the child will be unable to see the 20 line.

Failure. If the child reads the 20 line with the far-sighted glasses. this is reported as a failure.

3. Remove the clear glasses. Put on the red-green glasses and illuminate the red-green chart. The child should see the red dot inside the green rectangle.

Failure. If the child sees the red dot outside the limits of the green rectangle, this is recorded as a failure.

If the red ball and the green rectangle cannot be seen together when both eyes are open, this is recorded as a failure.

All failures must be re-checked. Return the child for a private re-examination, after the group test has been finished.

Failures indicate a need for an eye examination.

These simple instructions were sufficient to enable the nurse to examine accurately 799 children with relative ease.

The failure re-check is stressed because we found that 13 percent of the children, who failed during the group eye check, even though each child was tested singly, passed when given a private re-examination. A few of the false failures were due to a simple misunderstanding but most could only be attributed to a momentary mental inhibition or a lack of mental concentration. The re-check, therefore, is an essential part of any screening program and helps to eliminate the many false failures resulting from the human errors and misunderstandings so common in any mass examination.

The false referral problem cannot be overemphasized. The parent who goes to the trouble and expense of an unnecessary eye examination becomes antagonistic to the visual screening program and may even begin to question the motives of the program. I also cannot stress too much the importance of the eye examiner's role in explaining to the annoyed parent the situation wherein a child can fail a standard test and yet be visually capable of managing the defect without corrective eye care, depending on fusion power, adaptability, threshold for discomfort, and so forth.

It was thought advisable to continue through the entire test with each student to avoid complaints of neglect or discrimination. The time required to explain why the tests were being stopped at any particular stage negated any time saved by stopping at the point of failure.

Ordinarily, to avoid friction with local eye examiners children wearing glasses prescribed within the year were presumed to be receiving adequate eye care. However, for statistical purposes all children were included in our study.

The equipment

Actually anyone with a properly illuminated Snellen card, a plus 1.75 D. sph. glass, and our red-green test can perform this type of screening. For our purposes, however, an apparatus which combined the tests (fig. 1) was constructed. The chart consists of two parts. The upper part of the equipment houses the Snellen type, which is illuminated from below by a standard 20-W, cool white, fluo-

rescent tube. The lower part of the testing device consists of an illuminated light proof box, the face of which is cut out to contain the red and green test objects.

The face panel containing the diagram is removable by simply pulling it off the chart. This reveals the standard electric bulbs which light the test and a space for carrying all accessories while the test is being transported.

The upper and lower parts of the chart are on separate electric circuits, which are controlled by a two way toggle switch on a 25-foot cord, so that the examiner can manipulate the lighting while standing at the patient's side. When the test type is illuminated, the muscle chart is dark, and vice versa, so that no light will interfere with the phoria test.

The apparatus is easily portable and has no movable parts.

Visual screening programs

An adequate screening program cannot depend on equipment alone. A thorough educational program must be undertaken to acquaint the teachers, school administrators, parents, and children with the aims of the school screening program. School administrators must know the scope of the tests and be made sympathetic to its aims. Parents and teachers should be taught the "eye clues" indicative of visual distress so that they may recognize visual problems in the classroom or home. Parents should be made aware of the fact that human failures will give false referrals in any type of routine testing.

A good educational program produces a feeling of understanding and co-operation among parents, teachers, and the doctor; so essential to any project of this type. Under these conditions a visual screening program will have its maximum effectiveness.

Summary

We present a visual screening device, called the Atlantic City Eye Test, which was used in a preliminary study to screen 799 Atlantic City school children.

The test was fast, effective, easily understood, and did not give excessive false referrals.

I feel this is an improvement over existing school visual screening tests, and may be the answer to the agitation for an increased scope of visual screening in schools.

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I wish to acknowledge the co-operation of the school nurse, Miss Myrle Sampson, R.N., in testing the children, and the technical assistance of Mr. William Freund in constructing the equipment.

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THE INFLUENCE OF HYPERMETROPIA AND MYOPIA ON READING ACHIEVEMENT*

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Visual difficulties have been suspected for many years as one of the causes of reading failure. Starting with the hypothesis that a child cannot read if he cannot see the print, it has been deduced that anything which interferes with seeing or makes seeing difficult can impair achievement in reading.

Among the eye defects commonly suspected are the refractive errors.[1] These include hypermetropia, myopia, and astigmatic combinations of either or both.

Research has demonstrated a higher frequency of hypermetropia among reading failures and sometimes a higher median hypermetropia in the same group.[2-6] There is a general impression among investigators that myopia favors rather than hinders reading achievement.[5-6]

Very few studies have examined the relationship of the refractive errors to reading achievement in terms of educational test results. This is because most teachers and educational psychologists, though familiar with achievement tests, are not trained or equipped for ophthalmologic testing, just as the optometrists and ophthalmologists are generally uninformed as to psychologic testing. Some studies have been made by co-operating members of the two groups but, even here, lack of familiarity with the attitudes and goals of the partners has been a hurdle few have succeeded in surmounting.

PRESENT STUDY

The present study explores somewhat further the relationship of refractive error and reading achievement. The eye examinations and a large number of the educational tests were made by a person trained in both educational psychology and ophthalmology. The study is limited by the difficulty of obtaining the extensive data on a sufficiently large number of pupils at approximately the same grade level who have had closely comparable instruction in reading. When the comparatively small number of cases is subdivided according to the various conditions studied, the subgroups are correspondingly reduced in numbers.

The Gates Silent Reading Test was administered to a control group of 50 third- and fourth-grade pupils so that the reading achievement of pupils at this level in the system could be determined.

The test was also given to 57 pupils from the same grade levels who were passing in reading and to 64 who were failing. The criterion of failure was a sufficient retardation to have warranted referral to a reading specialist. All of the 121 members of the passing and failing groups received complete eye examinations (not screening tests). They were classified according to their refractive condition; emmetropic (no appreciable refractive error), hypermetropic (far-sighted enough to warrant use of glasses), and myopic (near-sighted enough to warrant use of glasses.)

To offset the difference in grade level and the age spread in the groups the difference between the chronologic and reading ages was taken as the measure of reading achievement.

Three main areas of comparison were made: (1) The nonfailing were compared with the control group, (2) the nonfailing were compared with the failing, and (3) the refractive-error groups were compared with the emmetropic group.

The control group exhibited a median difference between chronologic age and reading age of plus 0.6 year—that is, there appeared

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TABLE 1

COMPARISON OF THE DIFFERENCE BETWEEN CHRONOLOGIC AGE AND READING AGE OF READING FAILURES AND NONFAILURES, GROUPED ACCORDING TO REFRACTIVE CONDITION (GRADES III AND IV)

Refractive Condition	Passing in Reading			Failing in Reading			Difference	
	No.	Median (yr.)	Probable Error of Median (yr.)	No.	Median (yr.)	Probable Error of Median (yr.)	Median (yr.)	Probable Error of the Median
Control group	50	0.6	0.02	—	—	—	—	—
Emmetropia	21	0.6	0.21	10	−2.3	0.03	−2.9	0.04
Hypermetropia	27	0.6	0.53	46	−3.4	0.26	−4.0	0.10
Myopia	9	0.7	0.33	8	−2.7	0.04	−3.4	0.11

to be six months of acceleration beyond the test norm.

The nonfailing group presented similiar medians for the emmetropic and hypertropic cases but the median for the myopic subgroup was 0.7 years, which supports the widespread classroom observation that nearsighted pupils more often like books and succeed better in reading than those who are far-sighted.

The reading failure group presented uniformly minus (or retarded) medians. The emmetropic reading failures exhibited a median of −2.3 years which can be deemed the approximate level of retardation not influenced by refractive error. The hypermetropic failures showed a median of −4.0 years, while that of the myopic failures was −3.4 years. The median of the hypermetropic failures was −1.1 year more and the median of the myopic failures was −0.4 years more retarded than that of the emmetropic failures.

TABLE 2

COMPARISON OF HYPERMETROPIC AND MYOPIC READING FAILURES WITH EMMETROPIC READING FAILURES

Comparison	Difference (in medians)	Probable Error of Difference
Emmetropia-hypermetropia	1.1 yr.	0.04
Emmetropia-myopia	0.4 yr.	0.01

CONCLUSIONS

This appears to warrant the following conclusions for the present group and for all pupils of the same categories to the extent that this study is representative:

1. Refractive error appears to have little statistical influence on the reading achievement of pupils who are doing passing work.

2. Hypermetropia may contribute to considerable additional retardation among reading failures.

3. Myopia may contribute to some additional retardation among reading failures but to a lesser extent than hypermetropia.

4. The general impression that reading failures should have complete eye examinations to disclose possible eye handicaps is supported. When optometrists and ophthalmologists are not available for the purpose, use of one of the improved screening tests, such as the Eames Eye Test (World Book Company), Keystone Visual Survey (Keystone View Company), or the Massachusetts Vision Test (Welch Allyn Company) is desirable.

5. Similiar studies with much larger populations should be made.

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AN IMMUNOLOGIC STUDY OF RABBITS SENSITIZED WITH HOMOLOGOUS UVEAL TISSUE*

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INTRODUCTION

Generally, it is agreed that uveitis frequently demonstrates allergic manifestations. This ocular sensitivity may be classified into the granulomatous and the nongranulomatous types. Woods[1] states that in the granulomatous type the tissues are actually invaded by micro-organisms such as *Mycobacterium tuberculosis* and *Treponema pallidum* and the hypersensitivity results when the organism or its products again reaches the eye. On the other hand, the nongranulomatous type is believed by some to be a sterile allergic reaction resulting from intoxication with specific allergens.[1]

In 1903, Elschnig[2, 3, 4] postulated that sympathetic ophthalmia, a type of uveitis which is characterized chiefly by its tendency to involve the uveal tissue of both eyes, was an isoallergy to modified uveal tissue. Later, the recognition that certain tissues such as brain and lens protein possessed a greater degree of organ specificity than species specificity became perhaps one of the earliest demonstrations of the feasibility of autoantibody for normal tissues.

Attempts to produce isoallergic conditions in experimental animals are numerous but until recently results were difficult to obtain except by a long process involving many injections. Even then, the success was relatively poor. However, with the introduction of the adjuvant technique by Freund,[5] a method was devised which greatly facilitated the production of experimental isoallergic encephalitis apparently by enhancing the production of antibodies to homologous tissue extract. In fact, a single injection sufficed to produce this condition in some rabbits.

The present work was undertaken to study the serology and hypersensitive reactions which might occur in rabbits sensitized with homologous uveal tissue suspension with and without the aid of Freund's adjuvant.

METHODS AND MATERIALS

Unless otherwise noted, albino rabbits of both sexes and varying weights were used throughout these experiments. None of the animals had a history of infection.

All antigens used in this study were prepared from rabbit uveal tissue. All materials were stored, without preservatives, at −23°C. Thioglycollate broth was used to determine the sterility of all the antigens.

The uveal tracts were washed several times in saline. The tissue was then ground in a mortar and enough sterile saline was added to make dilutions of 1:10 and 1:20. The emulsion was placed in sterile vials. Each vial contained uveal tracts pooled from four or five rabbits. The 1:10 dilution of uveal suspension was used to sensitize the eyes,

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and the 1:20 dilution was employed for intravenous injections and for skin testing.

Albino, as well as pigmented, rabbits were used for the preparation of uveal-adjuvant emulsion. The inoculated mixture consisted of 0.5 gm. of uveal tissue, 3.5 ml. of mineral oil, and 10.0 mg. of killed and dried tubercle bacilli. The bacteria were ground in a sterile mortar and oil was gradually added. This mixture was then introduced slowly into an homogenate of uveal tissue and again ground in a mortar. This emulsion was stored at −20°C. until used.

The tubercle bacilli suspension for skin testing was prepared as follows: Previously killed and dried tubercle bacilli were reduced to a fine powder in a mortar and enough sterile saline was added to make a final concentration of 0.2 mg. of tubercle bacilli per ml. of saline.

The rabbits were divided into two groups:

GROUP I

Nine rabbits were inoculated intraocularly with 0.1 ml. of a 1:10 dilution of uveal extract. One-half percent pontocain was used as the local anesthetic. Only one eye was inoculated; the fellow eye served as a control. Normal nonimmunized rabbits also served as controls. A 27-gauge hypodermic needle attached to a 0.25-ml. tuberculin syringe was inserted tangentially into the anterior chamber at the limbus. Then 0.2 ml. of aqueous humor was removed. The needle was left in position and a new syringe containing 0.1 ml. of uveal suspension was exchanged for the one containing the aqueous humor. This material was then injected into the anterior chamber slowly. Extreme precautions were taken in order to prevent injury to the lenses.

After the nonspecific inflammation subsided, the rabbits were given one ml. of a 1:20 dilution of homologous antigen intravenously.

The rabbits were observed with the slitlamp and macroscopically immediately before the injection, one hour later, and afterward at indefinite intervals.

GROUP II

This group consisted of 18 rabbits inoculated into the footpads of both hind legs with uveal-adjuvant emulsion. The hair on the footpads was removed with an electric clipper and the pads were cleaned carefully with 70-percent alcohol. Using a 27-gauge needle and a 0.25-ml. tuberculin syringe, 0.05 ml. of this emulsion was injected intradermally into each of the footpads. All animals in this group were skin tested with 0.05 ml. of tubercle bacilli suspension and 0.1 ml. of uveal suspension. The right side and left side of the rabbits were clipped and cleaned thoroughly with 70-percent alcohol prior to the injections. Separate syringes and needles were used.

Animals from both groups were bled by cardiac puncture at weekly intervals and the sera were stored at −23°C. All the rabbits were observed daily either macroscopically or with the slitlamp for evidence of eye inflammation. Three rabbits from Group II were later inoculated intravenously as described above.

Controls consisted of two normal, nonimmunized animals which were injected intravenously with 1.0 ml. of uveal tissue and two immunized rabbits which received 1.0 ml. albumin by the same route.

Complement fixation tests were performed as follows:

The anticomplementary value of the antigens was determined before each series of tests. Commercially prepared, lyophilized complement was used throughout. Twenty-five hundredths ml. of 1:40 saline suspension of uveal tissue was added to a series of tubes containing the following amounts of antisera: 0.5, 0.2, 0.1, 0.05, 0.02 ml. Then, 0.1 ml. of complement, containing two units, was added to each. The tubes were incubated at refrigerator temperature overnight and then the indicator system was added.

Preliminary readings were made after the

tubes were incubated at 37°C. for 30 minutes, and final readings after storing overnight at refrigerator temperature. Serum, antigen, hemolytic system, and cell controls were included. The results were recorded according to the degree of fixation of complement. Gradations in fixation ranged from 4+ for complete fixation to − (minus) for absence of fixation.

Several methods were used in an attempt to transfer the hypersensitivity passively. The first method consisted of injecting each of two normal albino rabbits intradermally with 0.2 ml. of uveal antiserum into three sites, one of which served as a control. Eighteen hours later 0.1 ml. of antigen (homologous uveal extract) was injected into one of the sites and 0.02 ml. of the antigen was injected into another. An additional injection of 0.1 ml. of antigen was used as a control. The rabbits were then observed for anaphylactic and tuberculinlike reactions.

The second method was carried out as follows:

Three rabbits which had been immunized with uveal-adjuvant emulsion one and a half months prior to the test and two normal rabbits were given 0.2 ml. of rabbit uveal antisera into the anterior chamber of the right eye. Normal rabbit sera was introduced into the fellow eye of each animal as a control. The sera were obtained by cardiac puncture and precautions were taken to insure sterility. The eyes of the rabbits were examined daily macroscopically and periodically with the slitlamp. The titer of the sera was determined by complement fixation tests prior to the injections.

Findings

Animals in Group I demonstrated inflammatory reactions in the anterior chamber after the homologous antigen was given intravenously. In some animals the changes in the anterior chamber could be observed during the first 24 hours after the shock dose was administered.

These changes were manifested by lacrimation, injection of the vessels of the anterior segment of the eye, and the presence of flocculent material in the anterior chamber of the injected eyes.

Within three days, one could generally observe keratic precipitates on the endothelium of the cornea, aqueous rays, fibrinous exudates in the anterior chamber, as well as hyperemia of the circumcorneal, iris, and conjunctival vessels. Only one animal in this group demonstrated a sympathetic ophthalmialike reaction.

Periodic observations of rabbits in Group II with the slitlamp for several months failed to reveal evidence of ocular inflammation. Two rabbits (CI and CII) which had been inoculated with the uveal-adjuvant emulsion six months previously and one rabbit (DI) which had been sensitized with the same material for a period of three months were again observed with the slitlamp and appeared normal.

Immediately afterward, each animal received 1.0 ml. of a 1:20 dilution of aqueous uveal suspension intravenously. No evidence of inflammation of the eyes appeared after one hour. However, after 24 hours both eyes showed varying degrees of diffuse, fine, albumin-type precipitation on the endothelium of the cornea. No aqueous ray was noted and there was a minimal hyperemia of the iris vessels. The eyes appeared normal in four days.

The rabbits immunized with the uveal-adjuvant emulsion did not develop inflammation within four days after the intravenous injection of albumin. Likewise, nonimmunized rabbits did not demonstrate inflammation after the injection of aqueous uveal suspension intravenously.

In contrast, rabbits in Group I, which had previously demonstrated a local organ hypersensitivity 84 days before, did not show evidence of uveitis before or after the intravenous injection of aqueous uveal extract.

Complement fixing antibiodies were demonstrated in the sera of rabbits in Group I

TABLE 1

COMPLEMENT FIXATION TITERS OF SELECTED RABBITS IN GROUP II WHICH WERE INOCULATED WITH THE UVEAL-ADJUVANT EMULSION

Reciprocal of Serum Dilution	Rabbit Number							
	CI				CIII			
	Normal	Weeks			Normal	Weeks		
		2	3	5		2	3	5
12.5	—	1+	4+	3+	—	2+	1+	1+
25	—	1+	2+	1+	—	4+	2+	2+
50	—	2+	2+	1+	—	3+	3+	2+
125	—	2+	1+	±	—	2+	2+	±
250	—	1+	1+	±	—	1+	1+	—

(table 1). Significant rise in titer occurred during the third week after the inoculation. Normal antibodies were detected in titers of 1:12.5 and 1:25. The complement fixation titers were greater in the animals in Group II as compared with those in Group I (tables 2 and 3). The highest titers in the former were detected during the third week after the injections. No complement fixing antibodies were demonstrable in the aqueous humor of the injected eyes or in the controls.

As indicated in Tables 3 and 4, rabbits in Group II which were inoculated with uveal-adjuvant emulsion demonstrated a delayed type of skin hypersensitivity to the aqueous suspension of uveal extract. The skin reactivity, both to the uveal suspension and tubercle bacilli suspension, developed as early as four days after the inoculation and was still present two weeks later.

There was very little change in the degree of skin reactions to uveal suspension in the same rabbits tested four days and 14 days after the inoculations. However, the acid-fast bacilli suspension induced a greater area of hyperemia and induration after 14 days. The control rabbit, which did not receive uveal-adjuvant emulsion previously, was not sensitive to the uveal or tubercle bacilli suspensions.

Passive transfer of such skin sensitivity was not accomplished. The serum control was negative 24 hours after the inoculation. Approximately the same amount of erythema and induration appeared in the control site (antigen alone) as in the site containing the antigen-serum mixture. In 24 and 48 hours the antigen control and test areas showed the same amount of induration and erythema.

The attempts to transfer sensitivity passively by means of anti-uveal sera into the eye also were unsuccessful. An iritis and

TABLE 2

COMPLEMENT FIXATION TITERS OF SELECTED RABBITS IN GROUP I WHICH WERE INOCULATED INTRAOCULARLY AND SUBSEQUENTLY GIVEN AN INTRAVENOUS INJECTION OF HOMOLOGOUS ANTIGEN

Reciprocal of Serum Dilution	Rabbit Number				
	AI		AII		
	Normal	20 Days	Normal	5 Days	20 Days
12.5	2+	2+	2+	2+	2+
25	1+	2+	±	2+	2+
50	±	3+	±	1+	2+
125	±	2+	—	2+	2+
250	±	1+	—	1+	1+

TABLE 3

RESULTS OF SKIN TESTS WITH UVEAL SUSPENSION AND TUBERCLE BACILLI SUSPENSION FOUR DAYS AFTER INOCULATION

Rabbit Number	3 Hours		24 Hours		48 Hours	
	T.B.	Uvea	T.B.	Uvea	T.B.	Uvea
C1	–	–	++	++	+	±
C2	–	–	+++	+++	++	+++
C3	–	–	+++	++	+++	++
C4	–	–	++	±	++	±
C5	–	–	++	++	++	++
C6	–	–	±	±	±	±
C7	–	–	+	+++	+	++
C8	–	–	++	++	++	++
C9 (control)*	–	–	±	–	–	–

* Control did not receive uveal-adjuvant emulsion
– No reaction
± Barely perceptible erythema or induration (neither exceeding 5 mm. in diameter)
+ Erythema and induration between 5 to 10 mm. in diameter
++ Erythema and induration between 10 to 15 mm. in diameter
+++ Erythema and induration exceeding 15 mm. in diameter
++++ Very marked reactions with necrosis

circumcorneal injection developed within several days. However, the control eyes which were injected with normal rabbit sera produced a similar manifestation. This inflammation was considered nonspecific and was probably due to the intraocular injections. After a period of two weeks both eyes appeared normal and no evidence of uveitis developed during the three months of observation.

DISCUSSION

The experimental findings in the present work indicate that rabbits, which had been previously sensitized to uveal tissue intraocularly, develop changes in the anterior chamber as a result of a shock dose of homologous antigen given intravenously two weeks later. These manifestations varied in degree from one animal to another.

Generally, one could observe keratic precipitates on the endothelium of the cornea, aqueous ray, fibrinous exudates in the anterior chamber, as well as hyperemia of the circumcorneal, iris, and conjunctival vessels. Macroscopic evidence of inflammation occurred in a few animals and consisted of lacrimation and of hyperemia of the vessels of the anterior segment of the eye.

Only one rabbit out of seven in Group I

TABLE 4

RESULTS OF SKIN TESTS WITH UVEAL SUSPENSION AND TUBERCLE BACILLI SUSPENSION FOURTEEN DAYS AFTER INOCULATION

Rabbit Number	3 Hours		24 Hours		48 Hours	
	T.B.	Uvea	T.B.	Uvea	T.B.	Uvea
C1	–	–	++	++	+++	++
C2	–	–	+++	+++	++++	+++
C3	–	–	+++	++	+++	++
C4	–	–	+++	++	+++	++
C5	–	–	+++	+++	++	+
C6	–	–	++	+	+	±
C7	–	–	++	±	++	±
C8	–	–	++	++	++	++
C9 (control)	–	–	±	–	–	–

See Table 3 for legend.

demonstrated a sympathetic ophthalmialike effect. Other workers[6,7] have also noted a sympathizing effect in animals sensitized with foreign proteins.

The white precipitate which was seen in the anterior chamber in certain of the animals might have been the result of an antibody-antigen reaction in vivo. Foss[8] noted that if one injected 0.1 ml. of horse serum into the vitreous of rabbits and the same amount of antihorse serum was injected into the anterior chamber, precipitation occurred in the anterior chamber. The precipitates were partly deposited as a ring around the pupillary brim.

Rabbits in Group II which had been inoculated into the footpads with uveal-adjuvant emulsion did not show evidence of ocular inflammation during the several months of observation with the slitlamp.

Since trauma and infection will change the permeability of the surface membrane of the eye, various substances injected into the blood and which ordinarily would not get into the aqueous humor because of the normal blood-aqueous barriers, may now be found in the fluid of the anterior chamber.

This phenomenon may explain the development of eye inflammations which occurred in the rabbits in Group I and the failure of this reaction to appear in the eyes of the animals in Group II.

The former group received antigenic stimulation directly into the anterior chamber and as a result of the injection and paracentesis the normal blood-aqueous barriers were modified. Since residual inflammation was still present at the time of the shock dose, it is highly doubtful that these barriers were restored during the period of sensitization. Subsequent injection of the homologous antigen intravenously might permit the antigen to react with the preformed antibodies present in the aqueous humor.

In the rabbits of Group II, the barriers probably played an important role in preventing localization of the antigen in the anterior chamber. However, other possibilities for the failure to incite ocular inflammatory reactions by this method may exist. Perhaps the antigenic dosage which was incorporated in the adjuvant was too small to elicit an ocular manifestation.

Three animals which had been sensitized with uveal-adjuvant emulsion developed slight changes in the anterior chamber when large amounts of homologous antigen was inoculated intravenously even after an elapse of time of six months from the primary injections. This would indicate that larger amounts of uveal tissue added to the adjuvant might suffice to produce local organ hypersensitivity. Furthermore, it is conceivable that the local organ must be directly sensitized in order to produce an ocular inflammation.

The rabbits in Group I which demonstrated an ocular anaphylactic-type of reaction also had circulating antibodies two weeks after the initial inoculation. At the same time, the group of animals which did not develop ocular inflammation did possess complement-fixing antibodies. The highest titers were obtained after the third week of immunization with a slight decrease during the fifth week. The complement fixing titers generally correlated with the skin reactivity observed in the animals of Group II.

The demonstration of circulating antibodies, the presence of an Arthuslike phenomenon at the site of inoculation of the uveal-adjuvant emulsion, and the immediate response of the sensitized animals to a shock dose of homologous antigen would suggest an allergic reaction of the immediate type.

However, the majority of the animals in the second group which were skin tested demonstrated a delayed rather than an anaphylactic-type of skin reactivity.

This could be explained by the report of Dienes and Schoenheit[9] who found that proteins which induce anaphylactic sensitivity may give rise to a delayed type of sensitivity if such antigens are injected into a tuberculous focus. Later, Freund and McDermott[9] obtained the same effect when horse

serum, which normally gives rise to an immediate sensitivity was incorporated in an adjuvant. Whether or not this phenomenon is due to the presence of more than one antibody is not clear.

The fact that a mild ocular sensitivity in the animals in Group II was detected after a period of three and six months and no sensitivity could be demonstrated in animals in Group I after 84 days would indicate that Freund's adjuvant sustains sensitization for longer periods of time. This finding is in agreement with the results of other investigators.[9]

The work presented thus far would indicate that uveal tissue is antigenic since iso-antibodies can be demonstrated. Furthermore, this homologous tissue may cause an ocular inflammation and is capable of producing skin sensitivity. In part, these findings confirm the investigations of other authors[2, 10, 11] and further support Elschnig's theory of the possible immunologic mechanism of sympathetic ophthalmia.

Passive transfers by several methods were unsuccessful. However, this does not preclude the presence of sensitizing antibodies in the sera since complement fixation titer of the sera used for passive transfer was 1:250. Perhaps the antibodies are removed from the circulation and neutralized as quickly as they are introduced artificially into the animals or perhaps the complement-fixing antibodies are not responsible for the sensitization. Furthermore, the possibility that the antibody seemingly responsible for the inflammation of the eyes is of the sessile type should not be overlooked. Similarly, the many attempts by various investigators to produce encephalomyelitis passively by injecting large amounts of antibrain sera into animals have failed.

The possibility exists that sensitization might occur, not only to uveal tissue but also to a bacterial-uveal complex similar to the immunologic mechanism postulated for rheumatic fever and glomerulonephritis.

As mentioned previously, Cavelti[12] was able to demonstrate specific antibodies to kidney by immunizing animals with Group A streptococci and homologous kidney tissue. This same investigator also was able to demonstrate auto-antibodies to human heart extract in the sera of patients with rheumatic fever.

With such a mechanism, one can postulate an immunologic process in human uveitis involving three methods: (1) Sensitivity to a bacterial-uveal tissue complex, (2) sensitivity to uveal tissue, (3) sensitivity to bacteria and their products.

Diagram 1 shows the different pathways which might be involved in the production of hypersensitivity resulting in clinical uveitis. The paths on the right hand side of the bar indicate the generally accepted route in certain cases of uveitis, while the hypothetic mechanism, which is strengthened by the experimental results in this paper, is indicated on the right hand side. Modification of the uveal tract could result as a direct injury to the eye either mechanically or biologically. Likewise, in the experimental work, the removed uveal tracts undoubtedly were modified by mechanical grinding of the tissue.

The correlations of serologic, hypersensitive, and clinical manifestations in experimental animals immunized with homologous uveal tissue could lend support to an isoimmunologic mechanism which might occur in humans as a result of autosensitization to modified and normal uveal tissue.

Summary

Rabbits which were sensitized intraocularly and subsequently inoculated intravenously with homologous uveal tissue developed inflammatory reactions in the anterior chamber. This sensitivity could not be demonstrated 84 days after the intraocular injections. During the period of sensitization, complement-fixation tests demonstrated the presence of antibodies. Neither the skin nor eyes could be sensitized by passive transfer of anti-uveal sera.

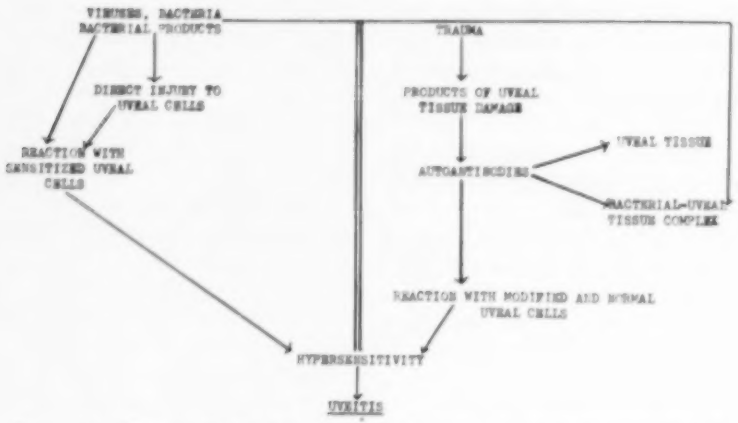

Diagram 1 (Suie and Dodd). Pathways which may be involved in the production of hypersensitivity resulting in clinical uveitis.

The rabbits which were inoculated into the footpads with uveal suspension mixed with Freund's adjuvant demonstrated complement-fixing antibodies and a delayed-type of skin reactivity. Ocular inflammation could not be elicited by this method of immunization.

Sensitivity to homologous uveal tissue was demonstrated six months later by the appearance of a fine precipitate in the anterior chamber following intravenous injection of the antigen. Passive transfer of this sensitization could not be demonstrated.

Failure to produce an experimental uveitis in these animals may be due to insufficient dosage of antigen or the presence of the blood-aqueous barriers in the anterior chamber. Furthermore, it is conceivable that the local organ must be directly sensitized in order to produce this manifestation.

The correlations of the serologic, hypersensitive, and clinical manifestations of experimental animals which were immunized with homologous uveal tissue are discussed.

Various suggestions are made concerning the possible roles of this type of isoallergic phenomena in human uveitis.

College of Medicine (10).

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CHEMICAL PRESERVATIVES FOR OPHTHALMIC SOLUTIONS*

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The many individuals engaged in ophthalmologic practice are familiar with the numerous publications on the recommendations for adding chemical preservatives to ophthalmic solutions. Much of this information is substantiated with authentic bacteriologic, toxicologic, pharmacologic, and clinical data. Therefore, it must not be construed that this report is original in the sense that it presents facts not already known to many ophthalmologists. On the other hand an attempt will be made to compile briefly the pertinent points on the general subject of chemical preservatives for ophthalmic solutions that have been published to this date.

The selection of a suitable chemical agent for preserving ophthalmic solutions from microbial contamination is by no means a simple procedure. This is particularly true in those instances in which ophthalmic drugs cannot be sterilized by heat because of the adverse effects of the latter treatment upon the chemical or physiologic properties of the drugs. The most desirable means for preparing and distributing sterile ophthalmic solutions would be by marketing them in single-dose containers in which the solutions were properly sterilized by filtration through one of the conventional bacterial filters that are available for this purpose.[1, 2]

The distribution of all ophthalmic drugs in single-dose containers to be used by the practitioner or the patient, however, presents several inherent problems. It not only involves the inconvenience of handling the individual container for each application, but also the high cost involved in manufacturing and distributing the individual items. It is for these reasons that most ophthalmic solutions used in office practice, as well as those prescribed for patients to use at home, are available in convenient multiple-dose vials or bottles, with or without an added chemical preservative.

Certain ophthalmic drugs have mild antibacterial properties which in themselves are poor mediums for the growth of the common pathogenic and saprophytic vegetative forms of bacteria that may accidentally gain access to the solutions when in use.

In those ophthalmic solutions lacking antibacterial (bacteriostatic) activity, microbial contamination can be expected once the container has been opened. This is especially true when little precaution is used to keep the medicine dropper sterile once it has been removed from the prescription vial or from the sterile, separate package that often accompanies the medication. It is to be expected that the applicator will be exposed to contamination by extraneous materials such as dust, water, and so forth, if the dropper is placed after use on a table or stored on the shelf in a medicine cabinet.

Another and significant source of possible contamination can be expected through contact of the dropper with an infected surface of the eyelid or eye of the patient or other person who had previously used the same applicator. The latter can be expected to occur most often in clinical or office practice. Evidence of this may be found in the report by Thygeson[3] of 42 cases of epidemic keratoconjunctivitis traced to the use of a contaminated dropper and an ophthalmic solution to which no chemical preservative had been added. Unless some preservative properties are present in the medication, attributable to the drug itself or to an added chemical bacteriostatic agent, one can expect a "contaminated" ophthalmic solution once the container is opened and used.

To my knowledge, there have been no published reports of infections from ophthalmic

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solutions by organisms causing contagious conjunctivitis due to the Koch-Weeks bacillus, Morax-Axenfeld bacillus, and related bacteria of the Hemophilus or of the Neisseria group. However, several recent reports indicate that certain ophthalmic solutions, although prepared under aseptic conditions, may ultimately be found to be contaminated by certain saprophytic bacteria, in spite of the fact that a chemical bacteriostatic agent had been added to the formula.

Objectionable contaminants that may be present in such solutions are organisms of the Pseudomonas and Proteus groups,[1, 2] both of which can cause serious ophthalmic complications and unfortunately are extremely refractory to present forms of chemotherapy.

"Contamination" evidenced by ophthalmic solutions becoming turbid probably led to the early practice of adding a chemical preservative. In many instances this turbidity was due to one or more of the active principals in the formulation settling or precipitating out of the aqueous phase. However, solutions that were not prepared under sterile conditions, or sterile solutions subsequently used for medication, might become turbid from bacterial or mold growths developing in them. In the early selection of chemical preservatives for ophthalmic drugs, mold control appeared to be the chief objective.

Table 1 presents a number of agents that have been used to control mold and bacterial growth. Of the series of preservatives listed in Table 1, the most widely used and effective compounds have been found to be chlorobutanol, phenyl mercuric nitrate, and benzalkonium chloride or Zephiran.®

Theodore and his associates[1, 3, 4] focused attention on the hazards of dispensing "contaminated" eye solutions. The work of Theodore and isolated reports of occasional serious corneal ulcers produced by highly resistant types of Pseudomonas aeruginosa probably prompted the Federal Drug Administration[5] to require that all commercial ophthalmic solutions be sterile and contain a bacteriostatic agent. The Council on Pharmacy and Chemistry[6] of the American Medical Association requires a manufacturer to show that adequate tests for sterility are made on solutions or suspensions for ophthalmic use before release of the finished products. Under the present regulations, however, small hospitals and retail pharmacies are exempted from these regulations. It is here that the use of chemical agents in eye solutions becomes of significant importance.

TABLE 1

PRESERVATIVES FOR OPHTHALMIC SOLUTIONS

1. Benzalkonium chloride (USP) (Zephiran®)
2. Camphor
3. Cetylpyridinium chloride (NNR) (Ceepryn®)
4. Chlorobutanol
5. Chloromycetin
6. Esters of p-hydroxybenzoic acid (Parabens®)
7. Formaldehyde sodium sulfoxylate
8. Furacin ophthalmic solution®
9. Gantrisin®
10. Phenylethyl alcohol
11. Phenylmercuric nitrate
12. Phemerol®
13. Polymyxin
14. Sodium propionate
15. Sodium sulfacetamide
16. Streptomycin
17. Sulfamylon®
18. Terramycin
19. Thimerosal (NF)

CHEMICAL AGENTS USED

In commenting on the several classes of compounds which have been used as preservatives, Theodore and Feinstein[2] said that, while the esters of p-hydroxybenzoic acid are good mold-inhibitors, they fail to inhibit the development of Pseudomonas in concentrations nonirritating to the eye. Furthermore, since relatively high concentrations of an alkali must be used in keeping the esters in solution, the increase in pH may have some adverse effect on the stability of the ophthalmic drugs.

Although the same authors had previously indicated the usefulness of Merthiolate®* in ophthalmic solutions, they subsequently pointed out[2, 7] that continued use of mercury

* Merthiolate,® Eli Lilly and Company brand of thimersal.

compounds may cause allergies. An alkaline pH is also required to maintain stability of the organic mercurial in solution. Phenol, chlorinated phenols, and formaldehyde sodium sulfoxylate were reported to be irritating to ocular tissues in concentrations high enough to be effective for bacterial inhibition.

A further consideration of preservatives for ophthalmic solutions by Theodore and Feinstein involved the cationic wetting agents of the benzalkonium chloride, cetyldimethylbenzylammonium chloride and Phemerol® types. These authors cited some objections to the use of these agents in ophthalmic solutions: (1) These surface-active quaternary ammonium germicides are unreliable against Ps. aeruginosa; (2) they are inactivated by high molecular anionic detergents and soap, and by natural rubber; (3) they are incompatible with certain ophthalmic drugs; (4) their antibacterial activity is interfered with by changes in pH.

With one or two exceptions it is doubtful whether the disadvantages listed are of practical importance in compounding quaternaries in ophthalmic solutions, as is evidenced from the publications of many workers who rely solely on the preserving action of this group of compounds. This will be discussed later in this review.

Chlorobutanol

In the concluding paragraphs in one of the publications by Theodore and Feinstein[2] chlorobutanol is advocated as the preservative of choice for ophthalmic solutions. This recommendation was based not only on their own findings but also on the earlier work of Morton[8] and McCulloch[9] on the same compound. Theodore mentioned, however, that, in certain ophthalmic solutions containing methylcellulose, the chlorobutanol may not inhibit some strains of Proteus vulgaris. Furthermore, since heat is required to dissolve chlorobutanol, precaution must be taken to avoid any adverse effects of high temperatures upon the active principles of the ophthalmic drug in the solution.

Theodore confirmed the earlier work of McCulloch[9] who reported that a 0.3-percent concentration of the preservative would prevent the growth of Ps. aeruginosa in solutions. However, Theodore and Feinstein reported that concentrations as low as 0.125 percent would effectively inhibit the development of "certain" strains of Pseudomonas and Proteus.

The amount of preservative required to inhibit effectively the development of all strains of possible contaminants in ophthalmic solutions should apply not only to chlorobutanol but to all other types of preserving agents.

Goldstein and Ryan[10] and Goldstein[11] included 0.5-percent chlorobutanol among several other preservatives (1:5,000 benzalkonium chloride, 0.5-percent phenol, 1:20,000 Thimerosal,* a combination of 0.18-percent methyl paraben and 0.02-percent propyl paraben, 0.5-percent phenylethyl alcohol) which they found effective in preserving a large variety of ophthalmic drugs compounded under normal pharmacy practice. Included in this report are lists of various compatibilities and incompatibilities that can be expected with the preservatives and the active principles in the formulations.

Givner[12] cites the work of Carbonaro who found that 0.5-percent chlorobutanol and several other agents (terramycin, 25 mg./5 ml.; Furacin®† ophthalmic liquid; 30-percent sodium sulfacetamide; chloromycetin, 25 mg./5 ml.; five-percent sodium proprionate) were of no value in destroying two strains of Ps. aeruginosa which she recovered from corneal ulcers. This is in contrast to her findings that five-percent Sulfamylon,®‡ benzalkonium chloride 1:5,000, streptomycin 10,000 µg./ml., Ceepyrn®§ 1:10,000, four-

* Thimerosal-sodium ethylmercurithiosalicylate.
† Furacin,® Eaton Laboratories, Inc., brand of nitrofurazone.
‡ Sulfamylon,® Winthrop-Stearns, Inc., brand of para-aminomethylbenzenesulfonamide.
§ Ceepryn,® Wm. S. Merrell Company brand of cetylpyridinium chloride.

percent Gantrisin®[¶], and 0.25-percent polymyxin were all effective in vitro as bactericidal agents for the same organisms.

Martin and Mims[13] mention the earlier work of Hermann, Moses, and Friedenwald[14] on the inhibition of oxygen uptake of the cornea by chlorobutanol and state that the use of this compound as a preservative for ophthalmic solutions is contraindicated.

In attempting to confirm an earlier recommendation on the use of the esters of p-hydroxybenzoates (parabens) for ophthalmic solutions, Hind and Goyan[15] found that the effective mold-inhibiting concentrations of these esters would produce a stinging sensation when applied to the eyes. A satisfactory substitute was found in a 1:5,000 concentration of benzalkonium chloride. This quaternary was used for several years for effectively controlling mold growth in ophthalmic solutions with no evidence of irritation to the eyes.

Phenylmercuric nitrate

Hind and Szekely[16] described six ophthalmic buffers and vehicles in which phenylmercuric nitrate (1:25,000) or benzalkonium chloride (1:10,000) was used effectively as antibacterial agents. The use of one agent in preference to the other was predicated upon the compatibility of the specific agent with the type of ophthalmic drug with which it was to be used. A list of drugs showing compatibilities and incompatibilities with phenylmercuric nitrate is given in Table 2.

Benzalkonium chloride

McPherson and Wood[17] examined the self-sterilizing properties of approximately 27 ophthalmic drugs to which a 1:5,000 concentration of benzalkonium chloride was added as the preserving agent. The solutions were prepared and examined without any precautions of asepsis and were tested bacteriologically at frequent intervals. This study revealed that all of the formulations remained sterile and no undue ocular reaction, such as irritation, which could be attributed to the quaternary ammonium compound developed.

In a similar study, Hughson and Styron[18] prepared a number of ophthalmic solutions with and without benzalkonium chloride and sterilized solutions by autoclaving. The solutions were kept in open containers at room temperature for 19 days during which time they were examined for the presence of viable organisms. All of the solutions without the germicide became contaminated, while those with the quaternary preservative remained sterile. The single exception was a two-percent solution of fluorescein, which was found to be contaminated with molds on the seventh day but which was found to be sterile again when tested on the 14th and 19th days of the test period.

TABLE 2

Compatibilities and incompatibilities of phenylmercuric nitrate with ophthalmic drugs[16]

Compatibilities*
Drugs
1. Cocaine
2. Dionin
3. Metycaine
4. Nupercaine
5. Optochin
6. Phenacaine
7. Pontocaine
8. Procaine
9. Syntropan
10. Fluorescein
11. Sulfisoxazole diethylanolamine
12. Sodium sulfacetamide
13. Sodium sulfadiazine
14. Sodium sulfathiazole
15. Zinc
Incompatibilities†
Drugs
1. Atropine
2. Ephedrine
3. Eucatropine
4. Homatropine
5. Pilocarpine

* Compatible when prepared in phosphate buffer pH 5.0 containing: boric acid—2%; phenylmercuric nitrate—1:25,000; in distilled water.

† However, compatible when prepared in phosphate buffer pH 6.8 containing: sodium acid phosphate, anhydrous—4 gm.; disodium phosphate, anhydrous—4.73 gm.; benzalkonium chloride—1:10,000; sodium chloride—4.3 gm.; distilled water—q.s. 1,000 ml.

¶ Gantrisin,® Wm. S. Merrell Company brand of 3,4-dimethyl-5-sulfanilamidoisoxazole.

TABLE 3

COMPATIBILITIES AND INCOMPATIBILITIES OF QUATERNARY AMMONIUM GERMICIDES WITH OPHTHALMIC DRUGS

Drugs	References and Concentrations Used
	Compatibilities
1. Acetate buffer	21 (1:5,000)
2. Alkaloids	22 (1:25,000)
3. Atropine	17, 18 (1:5,000); 16 (1:10,000); 23(?)
4. Boric acid*	24 (1:5,000)
5. Bromides	16 (1:10,000)
6. Carcholin	25 (1:5,000)
7. Cocaine	13, 17, 26 (1:5,000); 20, 27 (1:10,000)
8. Cortisone	28 (1:10,000)
9. Compound "75-G"†	29, 30 (1:50,000)
10. Ephedrine	16 (1:10,000)
11. Epinephrine	26, 31, 32 (1:5,000)
12. Eserine	18 (1:3,000); 17, 24, 33 (1:5,000)
13. Eucatropine	17 (1:5,000); 20 (1:10,000)
14. Fluorescein*	34 (1:5,000); 27 (1:10,000)
15. Homatropine	17, 35, 36 (1:5,000); 16 (1:10,000); 20 (1:10,000)
16. Hyaluronidase	37 (1:3,000)
17. Hydrobromides	16 (1:10,000)
18. Methylcellulose	39, 40 (1:5,000); 38 (1:50,000)
19. Neosynephrine	19, 40 (1:5,000)
20. Penicillin	19, 41 (1:5,000)
21. Phenazoline	40 (1:5,000)
22. Pilocarpine hydrochloride	18 (1:3,000); 17, 42 (1:5,000); 20 (1:10,000)
23. Pontocaine (tetracaine)	18 (1:3,000); 43 (1:3,500); 13, 17, 19 (1:5,000); 27 (1:10, 000)
24. Physostigmine	13 (1:1,000); 24 (1:5,000)
25. Procaine	44 (1:3,000); 27 (1:10,000)
26. Rose Hengal	45 (1:5,000)
27. Scopolamine	17 (1:5,000); 20 (1:10,000); 23(?)
28. Zinc Sulfate	13 (1:1,000); 27 (1:10,000); 33 (1:50,000)
	Incompatibilities
1. Boric acid*	10, 11, 19, 46 (1:5,000)
2. Fluorescein*	18 (1:3,000); 19, 46 (1:5,000)
3. Pilocarpine nitrate	19 (1:5,000)
4. Salicylates	46 (1:5,000)
5. Silver nitrate	19, 46 (1:5,000)
6. Silver proteinates	19, 46 (1:5,000)
7. Sulfathiazole sodium	19 (1:5,000)
8. Nitrates	19 (1:5,000)

* Reported by some to be compatible and by others incompatible.
† Schieffelin and Company brand of a basic ester of substituted phenyl acetic acid with spasmolytic, mydriatic, and cycloplegic activities.

Skolaut[19] found that benzalkonium chloride in a concentration of 1:5,000 was compatible with most ophthalmic drugs and afforded sterile solutions which did not require preliminary sterilization by autoclaving. He also discussed the various problems confronting ophthalmologists in the preparation of ophthalmic solutions, citing such factors as sterilization, irritation, stability, and activity of the respective solutions. A list of compatibilities and incompatibilities of various drugs with quarternary ammonium preservatives is given in Table 3.

In a more recent publication Scigliano and Skolaut[20] described the results of their studies in which they found a 1:10,000 concentration of benzalkonium chloride to be adequate in destroying cultures of Micrococcus pyogenes var. aureus, Escherichia coli, and Ps. aeruginosa that were intentionally added to various ophthalmic solutions. Note was made in the publication that the organisms used in the study were isolated from clinical material and that in most instances the bacteria were killed by the quaternary in a period of 30 minutes.

In addition to presenting a number of formulas of ophthalmic solutions in which

benzalkonium chloride is used as the bacteriostatic agent, Scigliano and Skolaut discussed the significance of the use of buffers, freshly distilled water, and a dating system to indicate the "shelf-life" of ophthalmic solutions.

Among his recommendations for preventing the transmission of epidemic keratoconjunctivitis Thygeson[5] advocates the use of individual sterile droppers instead of the conventional dropper bottles. In the discussion, Maumenee[5] referred to the experiences of McPherson and Wood[17] who found that 1:5,000 benzalkonium chloride in ophthalmic solutions was bactericidal for Escherichia coli, Ps. aeruginosa, and staphylococcus contaminants. Maumenee also stated that it was possible to sterilize solutions contaminated with the virus of herpes simplex and epidemic keratoconjunctivitis by adding methylene blue (1:20,000) to the solutions and then exposing them to light.

Rasgorshek[47] used various cycloplegics on 655 patients and found the most satisfactory agent to be five-percent homatropine in methylcellulose and benzalkonium chloride. Note was made in this report that the solution resisted contamination for a longer period of time and that the low surface-tension, due to the germicide, probably aided absorption of the homatropine into the ocular tissue.

In addition to noting that benzalkonium chloride increased corneal permeability of ophthalmic drugs, Martin and Mims[13] found that the preservative, in concentrations up to 1:5,000, prevented the development of molds even when the solutions were given every opportunity for contamination.

In a practical consideration of the use of benzalkonium chloride as a preservative for ophthalmic solutions, Krause, Dauer, and Guth[33] conducted a series of bacteriologic studies on solutions as compounded in a pharmacy. Two preparations were tested: zinc sulfate containing 1:50,000 of the germicide and a buffer for 0.5-percent eserine containing 1:100,000 of the same compound. No growth developed in either solution leading the authors to conclude that all compatible ophthalmic solutions should contain a bactericidal agent of the quaternary ammonium type.

Recommendations have been made by Hogan[27] on the use of 1:10,000 of a quaternary for preserving ophthalmic solutions. He indicated that this concentration would insure against contaminated solutions used in the office and clinic. However, Hogan mentions that ophthalmic solutions to be used for operations should be autoclaved to insure absolute sterility. In this instance the addition of 1:10,000 benzalkonium chloride will maintain sterility of the solution once the container is opened. Autoclaving drugs that are to be used for intraocular surgery has also been advocated by Morrison and Truhlsen.[48]

In addition to the preserving action of quaternary ammonium germicides, many ophthalmologists have used this class of chemical agents in ophthalmic solutions to speed the absorption of drugs in ocular tissues. Early reports by O'Brien and Swan[49, 50] indicate the use of 0.03-percent of benzalkonium chloride as a vehicle for Doryl to induce parasympathetic stimulation. Additional references to the use of the same quaternary with Doryl in the treatment of primary or chronic simple glaucoma may be found in the publications of Albaugh and Brady,[51] Venable,[52] and Wolfe.[53] A comprehensive discussion on the use of benzalkonium chloride as a wetting agent to enhance ocular penetration of choline drugs has been presented by Modell.[54, 55]

The low surface-activity of a 1:5,000 benzalkonium chloride solution was also found by Boyd[56] to increase the speed of penetration of physostigmine into ocular tissue. The salicylate salt of the latter drug was incompatible with the quaternary and for this reason use was made of the sulfate salt with which it is compatible. Scheie[57] has indicated that the quaternaries play a definite role in the treatment of primary glaucoma. He stressed their importance as enhancing

agents for penetration of drugs through the corneal epithelium to gain access to the anterior chamber of the eye. Vail[25] also includes a quaternary as one of the agents that may be used with ophthalmic drugs in the treatment of chronic simple glaucoma.

Feldman and his associates[58] examined a number of surface-active or "penetrating" agents as possible vehicles for ophthalmic drugs. In the group of compounds studied, a quaternary type of wetting agent proved to be a valuable antiseptic as evidenced by laboratory and clinical studies in the treatment of infections of the eyes. These authors also report that this surface-active agent is indicated as a vehicle for Pontocaine* and other ophthalmic drugs.

Chaimov[59] included a solution of benzalkonium chloride among the diluents that he used in preparing penicillin for ophthalmic use. Although no data were given for the advantages of the quaternary over normal saline or buffer solutions, this may be the first report that the antibiotic is compatible with quaternary ammonium compounds. Higgins,[60] on the other hand, used penicillin alone in one case of keratitis and one of conjunctivitis and found both conditions yielded to treatment with the antibiotic after argyrol, benzalkonium chloride alone, and sulfathiazole ointment had been used previously without success.

Although not directly concerned with the application of quaternary ammonium germicides as preserving agents for ophthalmic solutions, brief mention should be made to several references on the use of this class of compounds in other ophthalmologic practices.

Barr[61] included benzalkonium chloride in the treatment of various diseases of the conjunctiva. He found that the germicide was particularly effective in acute catarrhal conjunctivitis due to pneumococci or Koch-Weeks bacillus. Allen[62] used a 1:5,000 solution of benzalkonium chloride to treat difficult cases of acute blepharitis. Theodore[63] reported a case of persistent conjunctivitis of unexplained tearing due to mild dacryocystitis of mucoid character in a patient sensitive to penicillin and sulfa drugs. Irrigation of the infection with benzalkonium chloride solution and saline at weekly intervals resulted in an entirely normal conjunctiva within two months.

In studying the effects of a wide variety of agents upon intercellular cohesion in sheets of corneal epithelium, Buschke[64] found that many of the anionic detergents (synthetic soaps) will cause a dissociation of the latter into single cells upon subsequent shearing. The quarternaries, on the other hand, had no significant adverse effect on the epithelial tissue.

Shafer,[65] in doing corneal grafts of the lamellar type on rabbits, sterilized the surrounding skin with a 1:1,000 solution of benzalkonium chloride. Judd[66] objects to the indiscriminate use of antibiotics in the treatment of ocular infections and considers the conventional antiseptics, such as benzalkonium chloride, Metaphen,* and zinc as adequate for controlling cases of simple conjunctivitis. In the event these medications fail, he turns to the antibiotics, especially penicillin.

Grecar[67] describes a surgical procedure in which he used the buccal mucosa to restore the orbital socket. The entire face was prepared with soap and water and finally with a tincture of benzalkonium chloride. A packing of gauze wet with a 1:5,000 aqueous solution of the germicide is kept in the mouth throughout the operation.

Hauser[68] described the routine he used in examining for and removing a foreign agent. When an antiseptic was indicated he used a 1:4,000 aqueous solution of benzalkonium chloride and 50,000 units/ml. of penicillin drops in normal saline.

Robertson[69] treated dacryocystitis in in-

* Pontocaine,® Winthrop-Stearns, Inc., brand of tetracaine hydrochloride.

* Metaphen,® Abbott Laboratories, Inc., brand of the anhydride of 4-nitro-3-hydroxymercuri-orthocresol.

fants by probing the tear duct while the patient was under local anesthetic provided by Pontocaine.® After this treatment the parents were instructed to use a 1:5,000 aqueous solution of benzalkonium chloride four times a day for three to four days as an eye antiseptic until the discharge stopped.

Bell,[70] and Bell and Johnson[71] used a quaternary in a concentration of 1:10,000 as an irrigant before eye surgery. In listing some of the advantages, they cited that they observed no case of hypersensitivity or allergic reactions in their patients, nor was there any evidence of irritation that could be attributed to the solution.

Cohen,[72] on the other hand, found a patient who was sensitive to the quaternary which was added as a preservative in an ophthalmic solution. This individual showed a palpebral and periorbital dermatitis of three weeks' duration following the use of Antistine eye drops. Upon further examination by patch tests the patient proved to be sensitive to the quaternary rather than to the ophthalmic drug.

In his description of a new model of contact glass for gonioscopy, Troncoso[73] suggested the use of a 1:1,000 solution of benzalkonium chloride for cleansing the lenses. No mention was made in the article to the advantages of the use of the compound over that of other wetting agents.

Obrig[74] added 1:1,000 of a quaternary to a solution containing 30 ml. of a protein hydrolysate, 70 ml. of two-percent methylcellulose, and two gm. of potassium carbonate and found a marked increase in the time before clouding occurred.

Haffly and Jensen[75] advocated the use of a tincture of benzalkonium chloride for sterilizing the stopper surfaces of vials containing ophthalmic solutions. The detergent and germicidal actions of the solution would bring about a "sterile surface" within a matter of several seconds. An aqueous solution (1:3,000) of the same germicide was used by Berens[76] for the sterilization of instruments, sutures, and dressings in cataract surgery.

Post[77] found that, when instrument trays containing sterile water were exposed to the air for a few minutes, 100 percent contamination of the instruments occurred. The addition of 1:3,000 benzalkonium chloride to the trays provided sterile instruments for periods up to five hours without replenishing the solution. In only one instance among 742 cataract operations and 326 intraocular procedures of other types was there any evidence of a purulent infection which could be attributed to instruments which were inadequately sterilized by the quaternary germicide.

A note by Post indicated the low toxicity of benzalkonium chloride on ocular tissue as evidenced by the fact that, due to miscalculation, a 1:500 concentration of the germicide was used in the operating room for instrument sterilization during a period of one month in which time no cataract patient complained of corneal or iris disturbances.

The use of quaternary solution for the sterilization of optical instruments and appliances appears to be favored by various workers. Smith[78] indicated that corneal applicators can be successfully sterilized by a 1:1,000 aqueous solution of benzalkonium chloride and O'Day[79] used the same germicide for the sterilization of the surgical needles he used in general practice for the removal of corneal foreign bodies.

An indication that a quaternary germicide will prevent the transference of viruses from one patient to another may be found in an article by Friedenwald.[80] This investigator and others[81] recommend the use of benzalkonium chloride for the sterilization of tonometers. A comprehensive account on the use of the latter compound for general use in the sterilization of instruments in the eye operating room has been prepared by Clark.[82]

Summary

Wherever practicable, ophthalmic solutions

should be dispensed in individual, sterile single-dose containers without an added chemical preservative. Chemical preservatives should be added to all multiple-dose containers of eye solutions in accordance with sound pharmaceutical practices. Ophthalmic drugs which are not adversely affected by heat should be sterilized by autoclaving. Those which cannot withstand this form of treatment should, if possible, be sterilized by Berkefeld or Seitz filtration; however, if these facilities are not available, a chemical agent should be used to maintain sterility.

Since known chemical agents have certain shortcomings in their antimicrobial spectrums or certain chemical incompatibilities and undesirable irritating effects, the search for the chemical agent that can fulfill the requirements of the "ideal" preservative must be continued.

For the present, one must be guided in the selection of a preservative agent by the evidence that has been presented. A careful review of the literature reveals that in preparing and dispensing ophthalmic drugs, chlorobutanol, phenylmercuric nitrate, and benzalkonium chloride are considered the bacteriostatic agents most suitable for providing "self-sterilizing" solutions.

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Ophthalmic Miniature

". . . To civilization as to men there comes a moment when there is no step which, taken, can lead to health. No operation however drastic can make the parts work together, all for one end. Only a cordial, hot wine with some honey in it, can now avail."

Desmond Stewart's translation of
Memoirs of Alcibiades, pp. 80-81.

OBSERVATIONS ON THE OCULAR EFFECTS OF ERYTHROMYCIN*

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Erythromycin, a new antibiotic discovered in 1952, derived from Streptomyces erythreus, is said[1] to possess a wide spectrum of activity, particularly against the gram-positive organisms. It is effective by mouth in a recommended dosage of 300 to 400 mg. every eight hours; for children, 6.0 to 8.0 mg. per kg. of body weight are advised. In animals the toxicity is low[2] and, so far, no serious side effects have been reported from its clinical use, although mild gastro-intestinal symptoms occasionally occur.[3] Recently Livingood[4] reported that erythromycin is a very effective topical therapeutic agent for staphylococcic and streptococcic primary cutaneous infections.

The evaluation of erthromycin as an ocular therapeutic agent is the concern of this present study.

SENSITIVITY TESTS

Filter-paper discs 8.0 mm. in diameter, were saturated with various concentrations of the antibiotic and placed upon the surface of blood-agar plates which had just previously been heavily streaked from actively growing 24-hour blood-agar cultures of the bacteria. The zones of inhibition of bacterial growth were measured in 24 hours. These are recorded graphically in Figure 1, which indicates the preponderance of effectivity against the gram-positive organisms.

OCULAR PENETRATION STUDIES

1. INTRAVENOUS INJECTION

The left eyes of normal adult rabbits were prepared with a standard corneal abrasion produced by scraping away the epithelium within a circular area 3.5 mm. in diameter outlined with a trephine. The right eye of each animal remained intact. In the first group of animals 50 mg. erythromycin dissolved in 1.0 cc. of water were injected intravenously.

The animals were divided into three smaller groups, the first of which was killed at the end of one hour, the second at the end of two hours, and third at the end of four hours. The concentration of erythromycin in μg. per cc. in the heart blood, cornea, aqueous, and vitreous was determined by the filter-paper disc method and are listed in Table 1. Each figure represents the average of at least three animals.

The same procedure was repeated on another group of adult rabbits which received 100 mg. erythromycin in 1.0 cc. of water intravenously. The levels in μg/cc. are tabulated in Table 2.

Apparently small but theoretically adequate aqueous levels for gram-positive organisms can be expected from intravenous injections at the end of one hour. In larger doses the inflamed cornea may even be benefited.

2. SUBCONJUNCTIVAL INJECTION

One eye of normal adult rabbits was prepared with a standard corneal abrasion. Bulbar subconjunctival injections of 10 mg. erythromycin in 1.0 cc. water were made into all eyes. Cornea, aqueous, and vitreous levels were determined in one, two, and four hours. The results in μg./cc. are listed in Table 3, each figure representing the average of six eyes. Adequate corneal and aqueous levels are produced up to four hours, small vitreous levels up to two hours.

3. CORNEAL BATH

Another group of rabbits was prepared with a standard corneal abrasion of one eye.

* From the Research Department, Wills Eye Hospital. Presented in part at the Sixth Annual Wills Conference on February 19, 1954, at Philadelphia. The erythromycin (Lactobionate, each 100 mg. of which equals 60 mg. erythromycin) used in this study was generously supplied by Dr. Josselyn of the Abbott Laboratories.

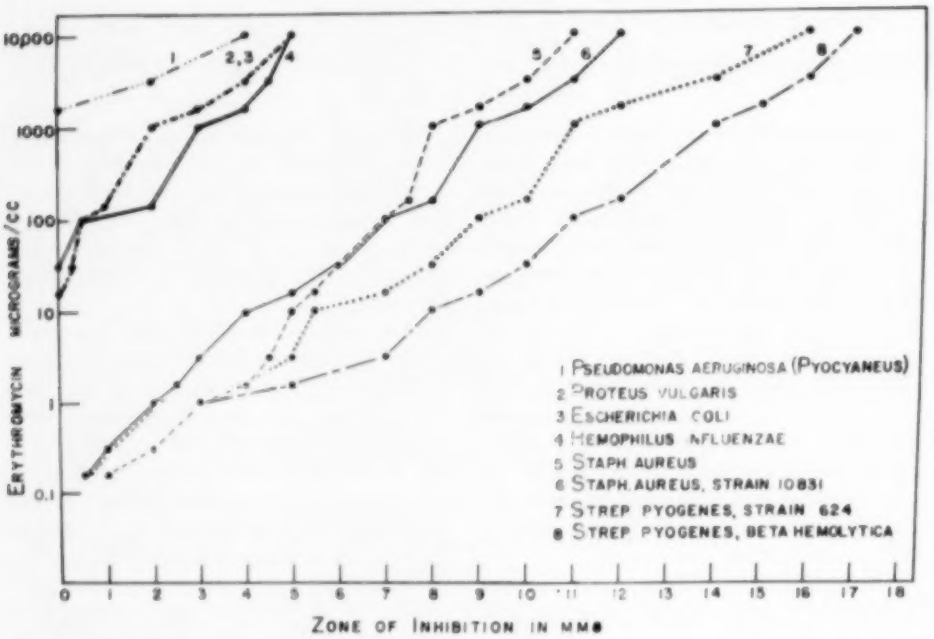

Fig. 1 (Naib, Hallett, and Leopold). Zones of inhibition of bacterial growth, showing preponderance of effectivity against gram-positive organisms.

A corneal bath of 25 mg./cc. erythromycin aqueous solution was applied to each eye for five minutes. Cornea, aqueous, and vitreous levels were determined in one, two, and four hours. The results in μg./cc. are listed in Table 4, each figure representing the average of six eyes.

Cornea and aqueous levels are adequate up to four hours. Vitreous levels are detectable only at the end of one hour.

4. Eye drops

Another group of rabbits was similarly prepared and then treated with drops of erythromycin aqueous solution in a concentration of 25 mg./cc. The drops were instilled every 10 minutes for one hour. Cornea, aqueous, and vitreous levels were determined as above and listed similarly in Table 5, each figure representing the average of six eyes. The results were quite similar to those obtained with the corneal bath.

Ocular tolerance studies

1. Subconjunctival injection

Four normal adult rabbit eyes were used. Injections of 0.5 cc. volume were made under the superior bulbar conjunctiva of each eye twice daily for three days. The first eye received a concentration of 40 mg./cc.; the second, 20 mg./cc.; the third, 10 mg./cc.; and the fourth, 2.0 mg./cc.

Twenty-four hours later the 40-mg. eye presented slight mucoid discharge, a congested and thickened conjunctiva, and slight corneal haze. The 20-mg. eye was congested and the conjunctiva thickened. The 10-mg. eye showed slight congestion, and the 2.0 mg. eye was clear.

Forty-eight hours later the 40-mg. eye presented swollen lids, congested and thickened conjunctiva, and opacification of the cornea especially in its upper fourth. The 20-mg. eye had a congested and

TABLE 1

INTRAVENOUS INJECTION OF 50 MG. ERYTHROMYCIN (μG./CC.)

Time (hr.)	Blood	Intact Eye			Abraded Eye		
		Cornea	Aqueous	Vitreous	Cornea	Aqueous	Vitreous
1	0.8	0	0.6	0	0	0.7	0
2	0.5	0	0.2	0	0	0.2	0
4	0	0	0	0	0	0	0

thickened conjunctiva. The 10-mg. eye was slightly congested and the 2.0-mg. eye remained clear.

Seventy-two hours later the 40-mg. eye remained congested and its corneal haze persisted. The other eyes were clear.

At the end of one week, the 40-mg. eye was slightly congested and a faint corneal haze remained. The other eyes were clear.

Apparently subconjunctival injections in concentrations above 2.0 mg./cc. are quite irrritating and may produce corneal opacification.

2. CORNEAL BATH

Four normal rabbit eyes were bathed five minutes twice daily for three days. The concentration of erythromycin in the corneal bath applied to the first eye was 20 mg./cc.; to the second eye, 10 mg./cc.; the third eye, 5.0 mg./cc.; and the fourth eye, 1.0 mg./cc.

Twenty-four hours later all eyes were clear. Forty-eight hours later the 20-mg. eye was slightly congested, the other eyes were clear. Seventy-two hours later and at the end of one week all eyes were clear.

Apparently corneal baths in concentrations up to 20 mg./cc. are innocuous.

3. EYE DROPS

Four times daily for three days two drops of erythromycin solution were instilled into four normal rabbit conjunctival sacs. The first eye received a concentration of 20 mg./cc.; the second, 10 mg./cc.; the third, 5.0 mg./cc.; and the fourth 1.0 mg./cc. All eyes remained clear when observed at the end of one, two, three, and seven days. Obviously eye drops in concentration up to 20 mg./cc. are harmless.

4. INTRACAMERAL INJECTIONS

Four normal adult rabbits received an anterior chamber injection of 0.1 cc. of erythromycin solution. The first animal received a concentration of 50 mg./cc.; the second, 25 mg./cc.; the third, 10 mg./cc.; and the fourth, 5.0 mg./cc. The opposite eye of each animal was injected intracamerally with 0.1 cc. of saline solution, as controls.

At the end of 24 hours the 50-mg. eye presented an edematous and congested conjunctiva, a hazy cornea, a turbid aqueous, hyperemia of the iris, and a membranous exudate in the pupillary area. The 25-mg. eye had a congested conjunctiva, hazy cornea, hyperemic iris, and exudate in the anterior chamber. The 10-mg. and 5.0-mg. eyes showed only slight conjunctival congestion with small flakes in the aqueous. The control eyes were all clear.

At the end of 72 hours the 50-mg. eye

TABLE 2

INTRAVENOUS INJECTION OF 100 MG. ERYTHROMYCIN (μG./CC.)

Time (hr.)	Blood	Intact Eye			Abraded Eye		
		Cornea	Aqueous	Vitreous	Cornea	Aqueous	Vitreous
1	1.7	0.1	0.7	0.1	0.4	0.7	0.1
2	0.3	0	0	0	0	0	0
4	0	0	0	0	0	0	0

TABLE 3

SUBCONJUNCTIVAL INJECTION OF 10 MG./CC. ERYTHROMYCIN (μG./CC.)

Time (hr.)	Intact Eye			Abraded Eye		
	Cornea	Aqueous	Vitreous	Cornea	Aqueous	Vitreous
1	95	39	5	121	288	4
2	37	33	1.2	77	76	1.4
4	7	9	0.3	7	5	0.2

TABLE 4

CORNEAL BATH WITH 25 MG./CC. ERYTHROMYCIN (μG./CC.)

Time (hr.)	Intact Eye			Abraded Eye		
	Cornea	Aqueous	Vitreous	Cornea	Aqueous	Vitreous
1	9	9	0.9	14	9	0.8
2	4	3	0	6	2.7	0
4	1.6	1	0	1.3	0.5	0

TABLE 5

EYE DROPS OF 25 MG./CC. ERYTHROMYCIN (μG./CC.)

Time (hr.)	Intact Eye			Abraded Eye		
	Cornea	Aqueous	Vitreous	Cornea	Aqueous	Vitreous
1	4.4	2.4	0.5	9	10	1
2	1.4	1.6	0	1.6	2.1	0
4	1.4	1.3	0	1.7	1	0

developed hemorrhagic congestion of the conjunctiva, the cornea was cloudy and superficially desquamated, the iris was hypermic, posterior synechias were evident, and the membranous exudate in the pupillary area persisted. The 25-mg. eye had a congested conjunctiva, cloudy cornea, and hyperemic iris but no exudate. The 10-mg. and 5.0-mg. eyes and the control eyes were clear.

At the end of one week the 50-mg. eye still had an edematous conjunctiva and infiltrated cornea, the iris was muddy, the pupil irregular, and the lens covered with deposits. The 25-mg. eye had an edematous, hazy cornea, a hyperemic iris, and an irregular pupil. All of the other eyes were clear.

It may be concluded that intracameral injections of erythromycin in concentrations greater than 10 mg./cc. are quite destructive.

SUMMARY

1. Erythromycin is an effective antibiotic agent in vitro for the gram-positive bacteria most frequently cultured in ocular infections.

2. Small but adequate aqueous levels for gram-positive organisms are produced at the end of one hour from intravenous injections of 50 to 100 mg. in rabbits.

3. Subconjunctival injections of 10 mg. produce adequate corneal and aqueous levels up to four hours, small vitreous levels up to two hours.

4. Corneal bath or eye drops in concentration of 25 mg./cc. produce adequate corneal and aqueous levels up to four hours and small vitreous levels at the end of one hour.

5. Corneal baths and eye drops in concentrations up to 20 mg./cc. are well tolerated but subconjunctival and intracameral injections above 10 mg./cc. are irritating.

1601 Spring Garden Street (30).

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Ophthalmic Miniatures

"The persons who seek the aid of the physician are very honest and sincere in their wish to get rid of their complaints and, generally speaking, to live as long as they can. However attractively the future is painted to them, they are attached to the planet with which they are already acquainted. . . . There is nothing men will not do, there is nothing they have not done, to recover their health and save their lives. They have submitted to be half-drowned in water, and half-choked with gases, to be buried up to their chins in earth, to be seared with hot irons like galley-slaves, to be crimped with knives like cod-fish, to have needles thrust into their flesh and bonfires kindled on their skin, to swallow all sorts of abominations, and to pay for all this, as if to be singed and scalded were a costly privilege, as if blisters were a blessing and leeches were a luxury. What more can be asked to prove their honesty and sincerity?"

Oliver Wendell Holmes,
In an address to the graduating class of
Bellevue Hospital Medical College, 1871.

* * * *

Feb. 26th, 1848

Good Mr. *Punch*,

Allow me to suggest to the Chancellor of the Exchequeur that, if he is still determined to make the poor pay for their window-glass, the rich ought to be taxed for their opera-glass. Neither do I see why people wearing spectacles ought not to pay the window tax.

Yours,
Philo Jenkins

From the files of *Punch*

NOTES, CASES, INSTRUMENTS

CONGENITAL ANOPHTHALMOS

WILLIAM P. ROBINSON, M.D.
Philadelphia, Pennsylvania

Congenital anophthalmos results from complete failure of the outgrowth of the primary optic vesicle. The essential nervous structures of the eye are, therefore, completely absent. If these structures are present, the abnormality is, in the strict sense of the term, microphthalmos, no matter how small the eye may be.

The literature on this subject is somewhat confused because of failure to differentiate the two conditions and, since extreme degrees of microphthalmos are indistinguishable clinically from anophthalmos, only those cases which have been histologically investigated should be accepted as genuine.

Doubt should also be thrown on those cases which show signs of inflammation at birth for it is possible that an inflammatory shrinkage of the globe may have occurred subsequent to its development. Syphilis may be an etiologic factor in these cases which might be termed "degenerative or consecutive anophthalmos."

Since any abnormality so gross as to produce complete suppression of that part of the forebrain which includes the optic plates makes survival unlikely, anophthalmos is a rare condition. However, sporadic cases do occur in otherwise well-formed children, although the condition is usually accompanied by abnormal development of the cerebral hemispheres and olfactory lobes and, frequently, by minor abnormalities elsewhere in the body.

Congenital anophthalmos is generally, but not always, bilateral; in cases in which one eye is present, the eye is usually abnormal and microphthalmic. The condition was remarked as a curiosity in the prescientific literature and was described by Thomas Bartholin (1657) in his *Anatomical Rarities*.

CLINICAL FINDINGS

The clinical picture shows a small, although a fairly well-formed, orbit. The lids may be rudimentary and, to some extent, adherent. The conical orbital cavity is lined by conjunctiva and is usually provided with a functioning lacrimal gland.

Cases have been recorded in which no trace whatever of an eye could be discovered but there may be minute traces of mesodermal elements which are only recognized with difficulty microscopically and may easily be missed. As a rule, however, there is a small nodular mass, situated at the apex of the orbit, which on histologic examination shows suggestions of the subsidiary mesodermal structures of the eye, such as fibrous (scleral) and pigmented vascularized (choroidal) tissues. A typical case of this nature was minutely described by Collins and Parsons[1] (1903).

The extrinsic ocular muscles are usually present, sometimes with normal innervation and powers of contraction. However, they are rarely sharply differentiated and may find insertion in an indiscriminate and tangled manner either into the subconjunctival tissue or into the rudimentary nodule; the latter may thus be susceptible of slight movement.

So far as the ocular structure is concerned, the cases may be divided into two categories: (1) Complete absence of an eye, (2) a rudimentary eye consisting only of mesodermal elements which are frequently pigmented (Duke-Elder[2]).

MacLean[3] reported 33 cases of congenital anophthalmos. Of these, 25 were bilateral and eight were unilateral. The ages of the patients varied from a few hours to six years; no account was given of their subsequent development. In five instances, a thorough anatomic and microscopic examination of the orbital contents was made; and in three of these a rudimentary nodule, com-

TABLE 1

FINDINGS IN SEVEN CASES OF ANOPHTHALMOS

Age	Laterality	Other Related Findings
6 wk.	Bilateral	Dark blue central zone in depth of conjunctiva
7 yr.	Left	Left microauricle; absence of left external auditory canal
41 yr.	Left	Oxycephalic
37 yr.	Right	
2 yr.	Right	
5 yr.	Left	Right eye showed nystagmoid movement. Had a corneal leukoma following active keratitis (makes one think that many of these cases are postinflammatory shrinkage or extreme phthisis bulbi)
4 yr.	Right	Sunken right side of face.

posed of a fibrous capsule enclosing a pigmented mass, was found. In the other two cases there was no vestige of an eye.

One only of the 33 cases came to autopsy; this case was reported by Gallemaerts[4] of Brussels in 1924. He stated that the skull was normal and that the occipital lobes were present. There was no trace of an optic nerve, chiasm, or tract. The orbital muscles were present. No trace of an eye, orbital cyst, or rudimentary nodule was found.

The family history of these cases is interesting. In 15 percent, some congenital anomaly existed in a parent or a relative. In three instances, more than one member of the family presented eye anomalies. McMillan reported four cases. All were members of the same family and children of normal parents. In one instance, there was bilateral microphthalmos: in three, there was anophthalmos on one side and microphthalmos on the other.

ETIOLOGY

Most authors feel that the condition is due to an arrest in development of the primary optic vesicle early in embryonic life. Mann[5] states that true anophthalmos results if one or both of the primary optic vesicles fails to bud out from the forebrain, but that the abnormality, though known to occur, is extremely rare, since an aberration of growth gross enough to produce complete suppression of the front of the forebrain, occurring at an early stage, is apt to end in the production of an embryo too abnormal to survive at all. In some instances, it is impossible to distinguish clinically between an extreme case of microphthalmos and anophthalmos. Only removal of the contents of the orbit, with careful microscopic examination, can determine the true nature of the case.

In 1935, A. Tiscornia and B. S. Tiscornia[6] reported four cases of congenital bilateral anophthalmos in a family of nine children. The ages were 19, 16, 14, and five years, respectively. Two were males and two females. Palpation of the orbital cavities gave indication of a rudimentary globe in only two of the cases. There was no evidence of hereditary lues or other causes in the family history. Another isolated case described showed consanguinity of the parents (cousins).

At the Wills Eye Hospital, the records were examined for the nine clinics. These records covered five years from 1948. It is interesting to note that, in these cases, the patients are still living. Seven cases of congenital anophthalmos were found (table 1).

At Nazareth Hospital since its opening in 1940, there have been a total of 23,396 births. The case to be reported is the only one recognized among these births. However, it would seem that many more cases of anophthalmos would be seen if these infants did not have so many other congenital defects that they survived only a few days or weeks.

CASE REPORT

Baby boy F. was born at 10:10 a.m. on June 11, 1953, in the Nazareth Hospital. It was a normal delivery, although a large baby, at full term. Low forceps were used. At the time of birth, there was an apparent deformity of skull, eyes, and orbits.

Upon examination of the eyes, both eyeballs were absent. Contracture and narrowness of the palpebral fissures with multiple symblepharon in the sockets were present. At the lateral upper rim of the orbit was a large bluish-red flaccid cystic mass which

seemed to be attached to frontal bone. Anophthalmos and dermoid or meningocele were diagnosed at that time.

The baby did not do well after birth and, in spite of supportive therapy, the course was downhill. The baby died on June 17, 1953. Post-mortem examination showed:

General external examination

The body was that of a newborn white male infant weighing 3,270 gm. The head was markedly deformed and there was an exceptionally large irregular fontanelle, with the opening extending down and including the bridge of the nose. There was a swelling on the occiput extending down to the neck, which was firm. This swelling was approximately 6.0 by 5.0 cm. The left eye appeared to be edematous but actually it was a fluctuating mass. The palpebral fissures could not be opened and were in one piece except for the external slits. The eyes were slanted upward and had a definite mongoloid expression.

The mouth presented no congenital abnormalities. There were no other signs of any congenital abnormalities. There was cadaverous lividity throughout the entire body, associated with rigor mortis. Cyanosis was marked in the lips and nail beds. The skin around the anus was excoriated. It was covered with zinc oxide ointment. The umbilical cord was dry. There was no inflammation at the base of the umbilicus. The abdomen was distended.

Brain and Skull

There was asymmetry and shortening of the head anteroposteriorly. The cranial circumference was 32 cm. On opening the skull, an extreme agenesis of the brain was seen, particularly the left cerebral hemisphere which was very short, approximately 4.0 by 3.0 by 2.0 cm. The right cerebral hemisphere was also flattened and the convolutions were not prominent. Unlike the usual infantile brain which is soft, both cerebral hemispheres were rubbery. There was no evidence of hemorrhage.

On the left side, there was a large cystic space comprised of a sac apparently made up of the dura and extending around and involving the entire parietal, occipital, and all of the frontal lobe as far down as the tentorium. There was no falx.

The fluid extended into the right ventricle and the pulvinar of thalamus could be easily visualized. It was joined anteriorly by the posterior portion of the exceptionally atrophic left hemisphere which was hard and rubbery. Inferiorly it was connected with the left orbit which had a hole in the orbital place approximately 1.7 cm. in diameter.

The tentorium was intact on both sides. The cerebellum, grossly, was normal, as was the medulla, but the pons was compressed. The quadrigeminal plate was badly deformed. It was not possible to trace out all of the cranial nerves but the olfactory and most of the optic tract could not be visualized clearly.

The optic chiasma was poorly formed. The basilar portion of the skull showed marked deformity. The right anterior fossa was 5.0 by 3.0 cm. The left anterior fossa was extremely shallow, 4.0 by 2.0 cm.

The clinoid processes were not prominent. The sella turcica was practically nonexistent and what seemed to be the pituitary gland rested on an almost flat surface.

The dehiscence in the frontal bone over the orbital plates extended from the left side to the right side in ovoid fashion and involved the cribriform plate. It had a honeycomb appearance and there was also a small group of openings into the right orbit. However, the large accumulation of fluid formed by the meninges and the cerebral hemispheres was not continuous into the right orbit.

The internal ears were apparently normal. Some residual, peculiar-looking tissue, approximately 1.0 cm. in diameter with a stalk, was in the left orbit, and this was assumed to be a rudimentary type of ocular tissue. More amorphous tissue mixed with bone was noted in the right orbit. Beneath the scalp in the pericranium, from the occipital bone to the base of the neck was a large hematoma. There was a similar hematoma on both sides of the anterior fontanelle.

Findings

Clinical absence of both eyeballs. Contracture and narrowness of palpebral fissures, with multiple symblepharon in sockets. At the lateral upper rim of orbit was a large bluish-red, flaccid cystic mass which seemed to be attached to the frontal bone.

Opinion

1. Clinical anophthalmos—bilateral.
2. Dermoid or meningocele of the orbit and frontal bone.

Roentgenologic report

The orbits are small and poorly developed, evidently due to anophthalmos. There is a well-defined, rounded soft tissue prominence ejecting from the superior left orbital area and this may well be due to a dermoid. The frontal bone is incompletely developed and only two supra orbital portions are present. There has been no significant development of the squamous portion of the frontal bone. The ethmoid bone is incompletely developed and the maxillary process of the frontal bone is absent. The nasal septum has not developed completely; only several irregular osseous fragments are present in this region. The sphenoid bone is poorly developed and the sella turcica cannot be identified. There is a rather extensive defect of the floor of the anterior cranial fossa because of the deficiency in development in this area.

The petrous portions of the temporal bones appear to be fairly well developed. The semicircular canals can be, at least partially, identified.

There is soft tissue prominence over the occipital region which may possibly be due to a meningocele, although a dermoid could also produce this appearance. No definite defect of the occipital bone is observed.

3327 Knorr Street (24).

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SPONTANEOUS RUPTURE OF LENS CAPSULE

In hypermature (morgagnian type) cataract

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Among the more unusual causes of acute glaucoma is spontaneous rupture of the capsule of a hypermature lens.

Other reported cases of rupture of the lens capsule differ from the following case in that here an intracapsular extraction with anterior sclerectomy and iris inclusion was planned and successfully executed.

Case report

Lee E., a 75-year-old white man, was seen on January 30, 1954. He stated that six days prior to this visit, while sitting quietly at home reading a paper, there was a sudden onset of aching in the right eye. As the evening progressed, the pain became worse. His eye became red and he was nauseated but did not vomit.

Aspirin and warm compresses afforded only slight relief. This therapy was continued for five days at which time the family physician was consulted and the patient was advised to seek immediate treatment by an oculist.

Eight years prior to this a cataract extraction had been done on the left eye. At the first attempt at extraction, a retrobulbar hemorrhage was encountered and the surgery was postponed. Several weeks later, after calcium and vitamin-K therapy, a successful extraction was done.

Vision was: R.E., poor light projection; L.E., 20/25+4 with a +10.5D. sph. ⊂ +1.5D. cyl. ax. 168°.

The right eye was congested; ciliary injection was present. The cornea was edematous and thickened. The anterior chamber was moderately deep and filled with a milky fluid in which were myriads of glistening white particles. There were no convection currents and no deposits on the posterior corneal surface. The pupil was moderately dilated and regular. The right lens was milky and no nucleus could be seen. The capsule appeared thinned but without a break. The aphakic left eye was apparently normal externally. Fundus examination revealed early hypertensive changes in the blood vessels. Tension was: R.E., 60+ mm. Hg; L.E., 18 mm. Hg (Schiøtz).

A retrobulbar injection of 1.5 cc. of two-percent procaine hydrochloride and epinephrine (1:50,000) relieved pain immediately but the intraocular pressure remained elevated.

A diagnosis of hypermature cataract with spontaneous rupture of the lens capsule was made.

The patient was admitted for surgery and given morphine sulfate (0.25 gr.) immediately. Pilocarpine (one percent) and eserine (0.5 percent) were begun at 15-minute intervals.

The following morning tension was 40 mm. Hg (Schiøtz) right eye. That afternoon, the cataract was extracted and an anterior sclerectomy with iris inclusion was done (W. L. H.). On puncturing the cornea a small amount of milky aqueous with fine crystals in it escaped. When the lens was extracted with the erisophake, the nucleus could

be seen floating inside the capsule at the lower part as the erisophake was rotated into various positions. No tear could be seen but gradually the milky fluid was lost into the erisophake and only the capsule and brownish nucleus remained on the cup.

The operation was uneventful and reaction was considered moderate at the first postoperative dressing. Recovery was rapid and the patient was discharged on the eighth postoperative day.

The intraocular pressure two months later was: R.E., 20 mm. Hg (Schiøtz); L.E., 20 mm. Hg. Vision of the right eye was 20/30 with best correction.

Discussion

Glaucoma following spontaneous rupture of the lens capsule has been reported by several authors. von Szily[1] (1884) reported two cases of von Ulrich and von Arlt. In 1913, Rollet and Genet[2] presented a typical picture of rupture of hypermature lens of the morgagnian type and specifically described white fluid in the anterior chamber with increased intraocular pressure.

In 1919, Gonzalez[3] reported the case of a personal friend; he, therefore, was able to exclude trauma as a causative factor. He also mentioned milky white fluid in the anterior chamber and increase in intraocular pressure. His case was treated with eserine only and the eye became quiet over a period of one year or more.

The first mention of cholesterol crystals in the anterior chamber in this type of case was by Safar[4] (1928). His case had increased intraocular pressure but he could not find a rupture of the lens capsule.

In 1933, Kaufman[5] mentioned cholesterol crystals in the anterior chamber and increased intraocular pressure in a case along with other cases of secondary glaucoma in hypermature cataract.

The same year, Daily[6] reported a case of an 83-year-old man in whom a mature cataract had been diagnosed nine years previously. The patient had a painful eye for two months prior to consulting the oculist. Examination revealed a deep anterior chamber and a cloudy cornea. It was not specified whether the aqueous in the anterior chamber was clear or milky in appearance. The tension was 70+ mm. Hg (McLean). Miotics and a paracentesis were of no avail. The eye was enucleated. A report from the Armed Forces Institute of Pathology indicated that there was a rupture of the capsule of the cataractous lens.

Box[7] and Ehrlich[8] reported cases of rupture (of cataractous lens) of the lens capsule, the first in a cataractous lens and the second in a lens with anterior lenticonus. Both of these cases showed no signs of increased intraocular pressure.

In 1938 Knapp[9] reported a case in which the anterior chamber was filled with shiny crystals and the intraocular pressure was 42 mm. Hg (Schiøtz). He performed an extracapsular extraction. At the time of operation, prior to insertion of any instrument, a tear in the anterior capsule was seen.

Sugar[10] reported three cases of spontaneous rupture of the lens capsule in hypermature lenses. In one case two small holes in the anterior lens capsule with tufts of lens material protruding were seen.

Scott[11] reports three cases this year: the first case was treated by irrigation and broad iridectomy; the second was irrigated only and has had continued attacks of iritis; the third case cannot be included as a spontaneous rupture due to a previous history of trauma.

In none of these cases has an intracapsular cataract extraction been done.*

The rupture of the lens capsule in the case reported here must have been minute indeed in order for the lens to retain its shape

* Dr. Ellis Gruber, in a presentation at the New York Academy of Medicine in March, 1954, described a case with secondary glaucoma and cholesterol crystals in the anterior chamber on which an intracapsular extraction was successfully done.

and still lose into the aqueous a part of the liquefied lens material.

Since there were no convection currents noted and the glistening particles were stationary in the anterior chamber it may be that the blockage of the angle by the liquefied lens material and crystal is one of the factors causing the acute onset of increased intraocular pressure.

SUMMARY

A case of spontaneous rupture of the lens capsule in a hypermature (morgagnian type) cataract with onset of secondary glaucoma is presented. It was treated by extraction of the cataract combined with an anterior sclerectomy and iris inclusion. Final vision was 20/30 with correction.

131 Fulton Avenue.

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OGUCHI'S DISEASE

A CASE REPORT

ALBERT C. BIEGEL,* M.D.
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Oguchi's disease is characterized by (1) night blindness, (2) grayish or yellowish discoloration of the fundus oculi, and (3) Mizuo's phenomenon. This condition has been well reviewed with discussion of the pathology and heredity by Elwyn† in his textbook. The case reported herein is presented because of the paucity of reports on the condition from the Western Hemisphere, and because of the unusual hue of the fundus discoloration in this case.

CASE REPORT

M. L. B., a 24-year-old white man of French extraction, entered the clinic complaining of poor vision at night for the preceding three years. He noted difficulty in finding his seat in movie theaters to such an extent that he was obliged to stand in the side aisle for 10 or more minutes waiting for sufficient dark adaptation to walk between the rows. Past history was noncontributory.

Family history revealed no known similar eye disorder. His mother died at age 64 with heart disease and diabetes. She had cataracts four years prior to death. His father is living and well. Two brothers, aged 45 and 41 years, are living and well. One sister died of an illness "like cancer" at the age of 30 years. No grandparents or other members of his immediate or distant family were known by him to have night blindness. Unfortunately geographic locations made it impossible to examine other members of his family.

The unaided visual acuity was: O.D., 20/15; O.S., 20/20.

Homatropine refraction revealed: O.D., +0.5D. sph. ⊂ +0.25D. cyl. ax. 90° = 20/15; O.S., +0.5D. sph. ⊂ +0.25D. cyl. ax. 90° = 20/15.

Ocular motility, tension, and anterior segments were all normal. The fundi presented a striking appearance. There was a bright

* Formerly Lieutenant (MC) USNR, attached to the First Marine Air Wing. The opinions expressed by the author do not necessarily represent those of the United States Navy.

† Elwyn, H.: Diseases of the Retina. Philadelphia, Blakiston, 1946, pp. 305-311.

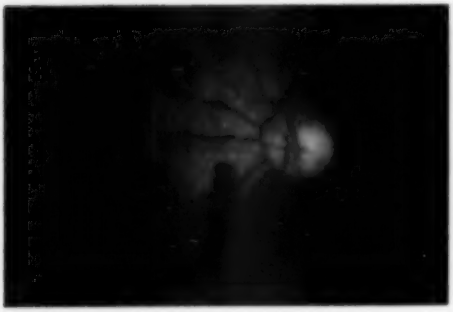

Fig. 1 (Biegel). Peripapillary region.

Fig. 3 (Biegel). Midperiphery.

"gold leaf" sheen throughout most of the fundus. It was most intense in the peripapillary and perimacular region (figs. 1 and 2) but could be seen distinctly out to the equator. The golden discoloration showed a more patchy distribution about the macula (fig. 2) and in the periphery (fig. 4). The retinal vessels appeared rather darker than normal. The disc (type III, Elschnig), was normal in color and outline with normal spontaneous venous pulsations.

The test for Mizuo's phenomenon was performed. After one hour in darkness the discoloration was still present; but after two hours it was absent, and the fundus had a completely normal appearance. (The dark appearance of the retinal vessels was also lost.) Upon exposure to bright light, the discoloration did not return immediately but when checked at two-minute intervals, was first noted at ten minutes. This entire phenomenon was demonstrated with identical results on another occasion.

Dark adaptation was quite defective. After two hours in darkness, the patient was unable to see the test object of the United States Navy radium plaque adaptometer, even when he was brought within five inches from it. A normal observer was able to make a perfect score after 20 minutes in the dark at a distance of five feet.

Color vision was found to be normal using Pseudoisochromatic plates (American Optical Company, 1940) and the Holmgren Wool Test. Peripheral and central field examinations were normal to 2/330 white and 2/1,000 white respectively. Routine urinalysis and blood counts were normal. Blood Kahn was negative. Blood sedimentation rate, nonprotein nitrogen, total cholesterol, total protein, and albumin-globulin ratio were all within normal limits.

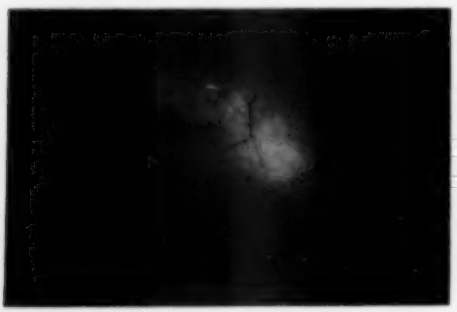

Fig. 2 (Biegel). Perimacular region.

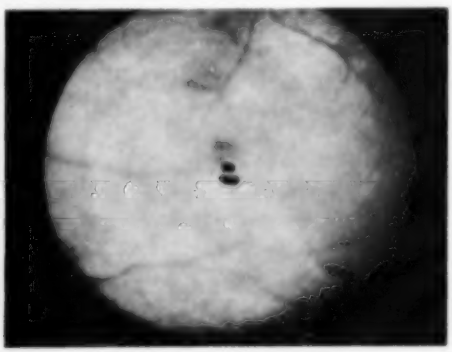

Fig. 4 (Biegel). Periphery.

Discussion

Nakamura classified Oguchi's disease as follows:

Type I

Discolorization of the fundus is marked. Mizuo's phenomenon is marked. Secondary dark adaptation occurs when the discoloration disappears.

Type II A

Fundus discoloration is mild. Mizuo's phenomenon is slight. Secondary dark adaptation does not occur.

Type II B

Fundus discoloration is slight. Mizuo's phenomenon is absent. Secondary dark adaptation does not occur.

Our case exhibited marked fundus discoloration and Mizuo's phenomenon but poor secondary dark adaptation. Therefore, it seems to be a variant of Type I or Type II A. A yellow or golden hue, as noted in this case, is apparently more rare than the grayish fundus discoloration. The only previously reported case of Oguchi's disease from the Western Hemisphere to our knowledge was that by Klien and by Wilder.*

Summary

A case of Oguchi's disease with yellow fundus discoloration, Mizuo's phenomenon, and poor secondary dark adaptation in an American man of European ancestry is presented.

3746 10th Street.

* Klien, B.: A case of so-called Oguchi's disease in the U.S.A. Am. J. Ophth., **22**:953, 1939. Klien's patient was presented again 14 years later by Wilder, H.: Society proceedings. Am. J. Ophth., **36**:718-719, 1953.

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SOCIETY PROCEEDINGS

Edited by DONALD J. LYLE, M.D.

NEW ENGLAND OPHTHALMOLOGICAL SOCIETY

413th Meeting

April 14, 1953

DR. ANDREW L. MACMILLAN, JR., *presiding*

RESULTS OF PTOSIS SURGERY

DR. CARL CORDES JOHNSON, Boston, discussed results of ptosis surgery in 162 operations on 142 eyes of 113 patients; 129 of these operations were levator resections of the type he had described before the society in 1947. In his series, in addition to the levator resections, there were seven Dickey operations, two Motai, three Berke's modification of the Motai, and 17 Friedenwald-Guyton frontalis suspension sutures.

Rules which were followed in selecting the type of operation to be used were:

I. UNILATERAL: (A) With levator action—levator resection (obviously if there is some levator function, the operation of choice will usually be some sort of resection or advancement of that muscle); (B) without levator action: (1) With superior rectus function that is normal or nearly so—(a) if strong binocular vision, a levator resection is usually to be preferred. If the superior rectus is used to suspend the lid, there is very apt to be some hypotropia, due to the weight of the lid pulling on the superior rectus, and this may produce annoying diplopia. In a young child, this may result in suppression and amblyopia; (b) if, however, there is no strong binocular vision, Berke's modification of the Motai is certainly the operation of choice (this must not be confused with Berke's more recently described modification of the Blascovicz). It is, Dr. Johnson believes, by far the best operation utilizing the superior rectus muscle. (2) With no or poor superior rectus function—this is the group, figures on which were given later, in which the poorest results are obtained. These patients are usually not candidates for suspension of the lid from the weak superior rectus, and they usually do not do well if the lid is suspended from the frontalis. This is because the brow has to be lifted in order for a frontalis suspension to work well. Patients with bilateral weak levators will lift the brows but those with a unilateral weak levator are less likely to do so. If they do, a frontalis suspension is indicated; if not, a levator resection.

II. BILATERAL: (A) With levator action—levator resection. (B) Without levator action: (1) With weak superior recti—frontalis suspension; (2) with fair or good superior recti—first choice, Berke's modification of the Motai operation, second choice, frontalis suspension; (3) when in doubt—levator resection.

The results of these 162 operations were classified as excellent, good, fair, and unsatisfactory. Fortunately, none were worse after operation than they were before.

A result was called excellent in a unilateral case if the operated lid was within 0.5 mm. of the height of the fellow eye, and if there was no great difference in their height in looking up and looking down; and, of course, the lid border must have a good curve with no tenting at the center. In a bilateral case, the result was called excellent if the two lids overlapped the cornea 2.5 mm. or less in primary position and functioned the same in looking up and down.

A result was called good in a unilateral case if there was 1.5 mm. or less difference in the height of the two lids and the result was pleasing in appearance, again without any uneveness of the lid margin.

In a bilateral case, obviously the result on one lid might be called good while the result on the other lid might be fair or unimproved.

A result was called fair if there was an appreciable improvement over the preoperative appearance and if the contour, and so forth, of the lid were pleasing, even if it were not as high as the fellow eye. In a case in which it was felt that the best possible result for that particular case had been achieved, it still was not listed as a good result unless it met the criteria for a good result, as just mentioned.

A result was classified as unimproved if there was not a marked improvement over the preoperative condition.

If the results of operations in all cases are lumped together, including the obviously hopeless ones as well as the favorable ones and including all three general types of ptosis operations done, there is, in this series, 67 percent in the combined excellent and good group—hardly a brilliant result. But if eyes instead of operations are used as a basis for these figures, it is found that 76 percent are in the excellent and good group. In other words, a second operation in many cases converts an unimproved or fair result to an excellent or good result.

If the figures are narrowed still further and only levator resections done in eyes with a normally functioning superior rectus muscle are considered, leaving out those few eyes with epicanthus and congenital blepharophimosis, the combined good and excellent result jumps to 85 percent. Eyes with a normal superior rectus are specified, because the results of levator resection operations are much poorer when the superior rectus is weak or paralytic. In this group, the percentage of good and excellent results falls to 56 percent, the lowest of all.

Only five percent of 142 eyes were unimproved and none were made worse.

It must be remembered that the criteria used were fairly rigid; and, in many cases, results have been called fair rather than good when the patient himself was quite happy with the result.

Slides which were fairly representative and illustrated how the cases were classified were shown.

Peripheral Iridectomy in Angle-Closure Glaucoma

Dr. Robert R. Trotter, Boston, pointed out that one must be aware of the existence of angle closure in a subacute form with recurrent small attacks often spontaneously subsiding. This form of glaucoma is similar in mechanism to the classical acute (acute congestive, uncompensated) glaucoma, but less dramatic in manifestation. It mimics, by its insidious damage and chronicity, the form of glaucoma usually called chronic simple or open-angle glaucoma.

Differentiation between subacute angle-closure and open-angle glaucoma is of vital importance because the former may be attacked surgically by a procedure of relative safety, namely peripheral iridectomy ab externo, whereas the open-angle type will require a fistulizing operation in the ordinary course of events. If, through failure thus to differentiate between these forms of glaucoma, a fistulizing procedure is done on an eye affected with subacute angle-closure glaucoma, the filtration mechanism may be further jeopardized or frankly ruined by flat chamber accompanying the fistulization. Conversely, but less dangerously, a peripheral iridectomy would be expected to offer nothing to an eye affected with the open-angle type of glaucoma.

A series of 14 of Dr. Paul Chandler's angle closure cases was presented to show the effects of peripheral iridectomy. Criteria for this and other operations were discussed in relation to the handling of neglected as well as favorable cases of angle-closure glaucoma.

Discussion. Dr. Paul Chandler: To me, the treatment of narrow-angle glaucoma, both the acute and the subacute types, if it is possible to make a correct diagnosis, is the

most thrilling experience in ophthalmology. Here is an opporunity, if the diagnosis is rightly made and made early enough, to achieve not palliation of the glaucoma or an arrest of the glaucoma, but, it appears, according to our experience thus far, a cure of the glaucoma. To see those patients come back to the office with or without drops with normal tension and no progression in their loss of field is a very thrilling experience.

You are all familiar with the acute types which were cured by iridectomy, but we may lose sight of what Dr. Trotter pointed out may be called the subacute or chronic types. These patients never get an irreversible attack with a tension of 70 or 80 mm. Hg which won't come down with drops; they have a tension of 40 or 50 or 60 mm. Hg and never become completely strangulated. The reason why they don't is apparently because some portion of their angle is wider than another portion; and at no time do they have the entire angle closed. These patients are just as amenable to peripheral iridectomy if done early as the acute types; and if they are done early, they need no drops in the postoperative period.

I think it must be emphasized, although there are many ways of doing operations, that, by and large, I am thoroughly convinced, seeing all types of incisions and sutures and so forth, that the best and safest way is an incision with the Bard-Parker knife—small incision with a tight closure with the suture. We have had patients in whom a knife incision has been made and the wound has been sutured, but it didn't hold; the anterior chamber became flat in the postoperative period, and we have lost the eye from peripheral anterior synechias as a result of a flat anterior chamber.

If a small incision is made and proper suture of the wound is carried out, there will be no flat anterior chamber in the postoperative period. There should never be a flat anterior chamber.

Another point which might be emphasized, particularly in the subacute or chronic types, is that in the immediate postoperative period —two, three, four, five, six days after the operation—when you go to look at the eye you may note the cornea a little steamy, and you think that the eye may feel hard. The tension may be 40, 50, 60, 70 mm. Hg; so you say, "Good heavens—whoever talked me into this operation? Peripheral iridectomy for this kind of glaucoma? Look what I have got on my hands now!" But in those cases, if it is early and the proper diagnosis is made, you need not be disturbed by these high tensions; just treat them conservatively and the tension gradually falls.

Dr. O'Connell from Hartford sent up one of these patients that Trotter reported. This patient had a tension of 65 mm. Hg in both eyes; he had a quadrant field defect. The tension promptly came down to normal with drops, but in a short time went back up to 60 mm. Hg; and it was 60 mm. Hg when I saw him. I thought it was perhaps early enough that he might be relieved by a peripheral iridectomy, and this was done in both eyes. Five days after the operation, the tension in one eye was 70 mm. Hg, the other was 50 mm. Hg; but we treated him vigorously with miotics for a few days and the tension gradually tapered off. Dr. O'Connell told me this afternoon—this must be a year or two after the operation—he was using pilocarpine four times a day, and his tension runs 19 mm Hg. He has a quadrant field defect. How much better off this patient is than if he had a trephining or iridencleisis operation.

In general, the best results are in those patients who have no field defect or a minimal field defect; but we are gradually developing a series of patients that have a quadrant field defect, and I have one patient who has lost the entire upper half of the field who had a peripheral iridectomy and is using two-percent pilocarpine, four times a day, and her tension stays at 22 mm. Hg or less. She is an individual with a small cornea and

prominent eye, and I think myself how much better off she is than if she had had the filtering operation.

I think it should be emphasized, furthermore, that we have a duty to perform in connection with the second eye. Except in aged and debilitated patients, I personally feel that we should really urge operation on the second eye. In every patient that has an acute glaucoma in one eye, I invariably strongly urge prophylactic peripheral iridectomy on the fellow eye. I think it is the greatest public health measure at our disposal in ophthalmology in the prevention of blindness. If you do it in the manner outlined, it is perfectly safe; and if you think it radical, then witness a few patients in which it wasn't done.

For instance, we had a patient, aged 75 years, with bilateral acute glaucoma, in whom the tension came down promptly to normal with drops. She was given pilocarpine to use at home and urged to come back to the hospital at the first sign of trouble. Ten days later, she reported to the hospital with light perception in each eye, with an extremely high tension, and little she got out of it after we lowered the tension.

Then there are the patients who, operated on in the presence of a high tension, go into malignant glaucoma. We had one of those not too long since.

When one thinks of the terrible situations one can get into with the second eye with malignant glaucoma and neglect on the part of the patient, I feel with a clear conscience that I not only advise but strongly urge prophylactic peripheral iridectomy on the fellow eye, and I find that patients accept this very readily. I think the reason they accept it is that I tell them in all seriousness that—and, by the way, my anterior chambers are pretty shallow—the minute someone makes a diagnosis on me, narrow-angle glaucoma, quick to the hospital, operation on both eyes. That I sincerely believe in and that I sincerely want done on both my eyes as soon as the diagnosis is made in one eye. Since I do feel it so sincerely, patients sense that sincerity; and I find that there is very little difficulty in convincing them of the value of the prophylactic operation on the second eye.

So, I should say that here is a method which, if applied early, effects not a palliative treatment but a cure of one form of glaucoma, and is the greatest public health measure that I know of at our disposal today.

As you know, I have always said heretofore that in aged and debilitated patients, "Let's see if they won't be controlled by miotics"; and I have one patient whose first attack, and only attack, of acute glaucoma occurred 25 years ago, and she has never had any trouble since. She is using pilocarpine; and I am sure many of you in this audience and you, Dr. Verhoeff, have many patients of that sort. But now I am beginning to move the age limit up higher because this patient that we had in the clinic not too long ago was 75 years of age. Her tension came down to normal with drops in both eyes, but she is the one that showed up 10 days later with light perception in each eye; so I say to myself, "We had it right in the palm of our hand to cure that patient there, and we didn't do it."

We had another patient who had acute glaucoma in one eye, neglected. We operated on that; it went into malignant glaucoma, so we decided before it developed in the other eye that we would do a prophylactic operation on the other eye. But, alas, we were so preoccupied with the first that the second eye blew up, and only by great good fortune did we get the tension down and do a peripheral iridectomy.

So, when these patients are in their 70s it is a question whether you should operate on them or not. I think if I were 75 and had an acute attack in one eye which was responding to drops, I would like a peripheral iridectomy.

If the patient is debilitated and in poor physical condition—well, let's take a chance.

DR. FREDERICK VERHOEFF: I have an acute case; I wonder if you would do the same as I did on it.

This patient had very shallow chambers; her mother died and, of course, she was very emotionally affected and came down with acute glaucoma. I did a peripheral iridectomy and cured that eye, but this patient was hysterical in the hospital—terribly hard to handle. Only one eye developed glaucoma—the other had just as much cause, but the tension didn't go up. I told her to use one drop a day in the other eye, and I haven't done the other eye because her trouble might result from emotional distress and an attack might even be precipitated by taking her to the hospital. She is one of those unstable individuals.

Would you regard that as an exception? She hasn't had the slightest attack in the other eye.

DR. PAUL CHANDLER: I certainly would not. I would strongly advise operation on the second eye, because I think sooner or later—

DR. FREDERICK VERHOEFF: Maybe I will turn her over to you to do it.

DR. PAUL CHANDLER: You cured one eye; you can cure the other one.

DR. WILLIAM BEETHAM: I'd like to make one statement and ask one question.

I have a man, 80 years of age, who has a wide-angle glaucoma, and he did not like pilocarpine because he has sclerosis of the nucleus of each lens, so I finally convinced him that peripheral iridectomy might possibly help him in lessening the frequency of the miotics. I did a peripheral iridectomy with a wide-angle glaucoma; and his tension, which was 32, 33, or 34 mm. Hg fell to about 20 mm. Hg, so he was really benefited because we could lessen the use of drops.

Now, the question I would like to ask is—Why does Dr. Chandler prefer peripheral iridectomy to a complete basal iridectomy aside from the cosmetic effect?

DR. ALBERT N. LEMOINE: Five or six years ago, we visited Dr. Cecil O'Brien's clinic in Iowa City, and he was doing cyclodialysis with a peripheral iridectomy in narrow-angle glaucoma. He showed us enough cases to convince us that it was of value in narrow-angle glaucoma, so we started doing cyclodialysis with a peripheral iridectomy in the region of cyclodialysis with excellent results in every case we have done.

After Dr. Chandler came out with his peripheral iridectomy, we questioned whether it was just the peripheral iridectomy or if the cyclodialysis had anything to do with it. So, since Dr. Chandler brought out his operation for narrow-angle glaucoma, we have been doing peripheral iridectomy in all of our narrow-angle glaucomas that were not well controlled.

Just like Dr. Chandler said, we have had excellent results in all of them; and it is such a mild operation for the patient, and the patient is over it in two or three days, I feel like Dr. Chandler does—where you have a narrow-angle glaucoma and have had one acute attack, I think you should operate both eyes. We have done it just as he suggested.

QUESTION: I would like to bring out for emphasis a small point that was expressed in Dr. Chandler's recent paper on narrow-angle glaucoma.

In the chronic narrow-angle glaucoma where there are peripheral anterior synechias, it is possible to run into the situation, after the ab externo incision, where you find to your surprise that the chamber does not collapse; the anterior synechias peripherally are so well organized that they do not allow the escape of the aqueous. Now, when a person does not expect that and has to think a minute in order to handle it, I think that he should recall that passing the iris spatula between the iris and the peripheral cornea, as suggested by Dr. Chandler, will help him a great deal. If he does not do that, of course, he is running into the difficulty of disturbing the lens.

I discussed this with Dr. Chandler recently. He feels that when there are many peripheral synechias, cyclodialysis is not necessary, but that it would be a good idea at that point to do an iridencleisis.

Dr. Merrill King: I think there is one thing that might be said for the interest of some of you. Hanging around up in the surgeons' room, I have heard the question brought up several times—What treatment do Dr. Chandler and Dr. Grant put the patient on when he or she is discharged from the hospital? The question is whether to have the pupil dilated and, if so, whether to use a mild mydriatic or a strong one. I think those questions should be answered because, personally, I have had one patient in whom the pupil is very small and the pupil is filling up with pigment; and I would like very much to hear what they would say about that.

Dr. Robert Trotter: I'd like to reply to Dr. Beetham's question about the periphery being affected in wide-angle glaucoma. Other things being equal, I wonder whether it was wide-angle glaucoma; and, secondly, I wonder, in the wide-angle glaucoma, whether the tension was taken at different times of the day.

The other questions I would refer to Dr. Grant.

Dr. W. Morton Grant: I refer it to Dr. Chandler.

Dr. William Beetham: May I say it was wide-angle glaucoma; it was their diagnosis.

Dr. Paul Chandler: In reply to Dr. Beetham's question about basal iridectomy, most of you here have cured many patients with acute narrow-angle glaucoma by the old basal iridectomy; but the reason why I think peripheral iridectomy in an early case is so much to be preferred to the classical basal iridectomy is official results.

We commonly find after peripheral iridectomy that the patient doesn't even have to change his glasses after the operation. There are cases that have a broad basal iridectomy that sometimes have two, three, as much as three diopters of astigmatism. Bill's don't, but mine do have that much astigmatism. You correct them with a lens; and they can perhaps barely make out the 20/20 line, but they say it is blurred.

I have a good friend, an oculist in New Hampshire, who unfortunately had his subacute attacks before peripheral iridectomy; and he has a great, broad, basal iridectomy about that wide (indicating) in each eye. His vision is corrected, but he says it "ain't the same as it was before."

The postoperative care Dr. King mentioned is very important. We all know that if, in a cataract operation or glaucoma operation of any type, the conditions are just right, a severe acute iritis may be started; and if we aren't careful about the pupil we may get it bound down and filled with pigment, as Dr. King stated, and I have some of those cases, alas.

So, I make a practice to dilate the pupils daily, beginning on the day of operation, with 10-percent neosynephrine. If the patients really develop a bang-up iritis, then I not only give neosynephrine but scopolamine or atropine and keep the eyes dilated until all the signs of acute inflammation are over. In those eyes in which tension is quite high, in subacute cases, it seems urgent to constrict them, but just as soon as the tension reaches a reasonable level, then I dilate again; but dilating the pupils in the postoperative care I think is quite important.

Dr. Frederick Verhoeff: How about cortisone?

Dr. Paul Chandler: Cortisone is used almost routinely.

Beta radiation therapy with strontium^{90} applicator

Dr. William F. Hughes, Jr., Chicago, speaker of the evening, first, re-evaluated results in the treatment of over 235 eyes during the past four years at the University of Illinois, using a radon applicator (previously described in Tr. Am. Ophth. Soc., **50**:469, 1952), especially in regard to the selection of

cases and undesirable reactions; and, secondly, presented the preliminary results and certain disturbing problems of the new strontium-90 applicator manufactured by Tracerlab, that portion of the work being done by Dr. Fred M. Wilson, Indianapolis, and Dr. James E. McDonald, Chicago.

The general dosages of contact therapy used with the radon applicator are as follows: 1.0 gm. sec., inflammatory conditions; 2.0 to 3.0 gm. sec., initial doses, very sensitive lesions, and in children; 4.0 to 5.0 gm. sec., deep corneal vascularization, limbal tumors, and vernal catarrh.

By comparison of the effect on the rabbit cornea of their radon applicator and a strontium-90 applicator, which was recently restandardized by Tracerlab, using a vanishing ion chamber, a very rough approximation of the rep. output of their radon applicator would be 2,000 rep. per gm. sec. (± 50 percent). Treatments are given every three to eight weeks, in general longer spacing and smaller doses being used now.

The general indications for beta therapy are the same as those for other radiation therapy such as X-ray or gamma radiation. The tissue to be destroyed must be more sensitive to radiation than the surrounding normal tissue. With extremely low doses, inflammatory conditions are apparently benefited. An indication for beta radiation therapy should imply that this therapy is not only effective but is superior to other methods of treatment because of the still somewhat uncertain effects of radiation therapy on the eye.

INDICATIONS FOR BETA-RADON THERAPY

Treatment of choice:
- Epithelial tumors of limbus and cornea
- Vernal catarrh, palpebral or bulbar forms associated with severe symptoms
- Vascularization complicating keratectomy and keratoplasty
- Rosacea keratitis
- Primary vascularizing keratitis
- Recurrent pterygium (after secondary excision)

Favorable results (low doses):
- Allergic and phlyctemular keratitis
- Papillomas and hemangiomas of conjunctiva
- Nodular episcleritis
- Granulation tissue

Uncertain results:
- Stromal herpes simplex (low doses)
- Basal cell carcinoma of lid margin
- Chemical burns (not recent)
- Tuberculous sclerokeratitis
- Interstitial keratitis
- Trachoma, Stage IV
- Salzmann's dystrophy of cornea with vascularization
- Lipoidal dystrophy of cornea with vascularization
- Old vascularized corneal scars

Not indicated because of undesirable features, better treatment available, or no effect:
- Primary treatment of pterygium
- Corneal scars without vascularization
- Fuchs' endothelial-epithelial dystrophy
- Epithelial downgrowth into anterior chamber
- Acute chemical burns
- Large doses for inflammatory lesions
- Cicatrizing conjunctival disease (for example, pemphigus)
- Nevi
- Pinguecula
- Tumors of lid margin

The complications which have attended beta therapy in some of these cases include:

1. Irritability of the eye lasting more than two weeks but eventually clearing entirely (10 percent of cases) following a dosage rate of 1.0 gm. sec. or more per week with a minimum total dosage of 15 gm. sec. applied anywhere on the surface of the globe.

2. Postradiational vessels and telangiectases which may develop one to three years after treatment with doses as low as 5.0 gm. sec. in one area.

3. Epilation of the lashes which can be produced by a dose of 4.0 to 6.0 gm. sec.

4. Deep corneal ulceration when there is pre-existing ulceration or infection and excessively large doses have been applied directly over the area. (This did not occur in their series.)

5. Epidermalization of the conjunctiva only when beta was used for epilation, the epidermis of the skin apparently overgrowing the conjunctival surface in the treated area.

6. Glaucoma which might be expected to be a complication of beta radiation therapy which renders the limbal region ischemic. However, the diagnosis of glaucoma is difficult in cases of advanced keratitis because

tonometric readings are unsatisfactory and associated conditions such as iritis can produce a secondary glaucoma independent of the beta radiation therapy. Glaucoma was suspected in seven eyes in which the total dose over the entire limbal region averaged 53 gm. sec.

7. The possibility of cataract formation following large doses of beta radiation has not been reported until recently. In two eyes with severe primary vascularizing keratitis, 44 to 51 gm. sec. in 16 to 18 weeks over the cornea and limbus resulted in cataract formation two and a half to three years later.

The new radioactive strontium^{90}-yttrium^{90} beta applicator first reported by Friedell, Thomas, and Krohmer in 1950, and studied by Wilson and McDonald, has several virtues; namely, long half-life of 20 years, relatively low cost, high output (40 to 100 rep. per gm. sec.) of pure beta particles of maximal energy 2.16 mev. (slightly less than radon), and average energy of 0.8 mev. (slightly more than radon) with depth doses comparable to radon.

Its disadvantages include: large size with an active surface 7.8 mm. in diameter, uncertainty about evenness of layering of the Sr^{90}, and apparent technical difficulties in measuring the rep. output by means of the vanishing ion chamber. Three applicators which have been restandardized after one or two years have shown an apparent drop in rep. output of 33 percent. Until the physical method of measuring the surface output of these applicators becomes consistent, it is mandatory that each applicator be standardized on a rabbit cornea. Wilson has termed the dosage necessary to produce a definite nebular opacity on the rabbit cornea which persists for two to three months the minimal inflammatory dose. With the change in physical measurements of the rep. output, the minimal inflammatory dose has decreased from 36,000 rep. to 20,000 rep. The clinical dose necessary to eliminate superficial corneal vascularization in humans is approximately 8,000 rep. (0.4 minimal inflammatory dose) according to the latest standardizations, and the skin erythema dose is about 1,400 rep. (Wilson). The clinical results with the Sr^{90} applicator using these doses are comparable to those obtained from radon. In flat preparations of rabbit lenses, Wilson has found nuclear pyknosis, fragmentation, and balloon cells in some of the epithelial cells 100 days after exposure to 1.7 minimal inflammatory dose (34,000 rep.). No clinical signs of cataract were present, and this does not represent a threshold dose.

What is a safe noncataractogenic dose of beta radiation? Unfortunately, such data are not available even for X-ray and gamma emanations whose ionization can be measured accurately. Cataracts can be produced in rabbits with X-ray doses as low as 200 r, but have not been reported in humans with divided doses totalling 400 r, and can, but not necessarily, be produced by 1,000 r.

Assuming that 400 r is noncataractogenic and that X ray can be approximately equilibrated with beta, a depth dose of five percent at four mm. using beta would indicate a noncataractogenic dose of only 8,000 rep. of beta applied to the surface of the cornea. It is probable that this dose is unduly low because: (1) the reported rep. output of the beta applicators may still be unduly high on an absolute basis which could be compared to the ionization produced by X rays; (2) the entire lens is not exposed after treatment with small beta applicators, so the safe dose may be 8,000 rep. in any one area; (3) the possibilities exist that histologic changes in the lens epithelium can take place without cataract formation, that recoverability is possible, or that opacities may remain localized and nonprogressive.

In conclusion, Dr. Hughes said, the question probably arises, is beta radiation too dangerous to use on the eye? Beta radiation, especially with the new Sr^{90} applicator, should be considered experimental. A more consistent physical measurement of output is needed so that clinical dosages can be standardized and more accurate depth doses

be obtained. Beta radiation should be used only in specific cases in which it has a good rationale and is superior to all other methods of treatment. Minimal doses and more protracted intervals between treatments should be employed. A calculated risk of cataract is present if a total dose of over 10 gm. sec. of radon is given in any one quadrant and more than 30 gm. sec. over the entire globe with a radon applicator of their size, and an estimated 16,000 rep. in one area with the Sr^{90} applicator.

Discussion. Dr. David Cogan: I was really waiting for Dr. Leahey to open the discussion because he has had much more experience with the clinical application of this than I have.

I want to say first that Dr. Hughes has given us a lot of information and dosages which I am glad to have for my files. He has also cautioned us about applying it to the various applicators indiscriminately.

The applicator I have here was one deposited with us, and I accepted it rather innocently because of a telephone call saying that they would like, this particular company, to deposit this applicator for whatever purposes we desired, and that sounded very nice; but you have heard the old story—those that come bearing gifts, beware of them.

I accepted it and then I found I had gotten into a lot of red tape with the Atomic Energy Commission in filling out forms. After about six months had gone by, I was told I wasn't entitled to use it on human beings anyway. I think that is one of the main objections. If that is true, others have the same experience with this strontium applicator. The Atomic Energy Commission has rather arbitrarily set up criteria that make it far different from the standard, the other radium-D applicator, in that it comes under some law that requires a filing of affidavits and the like before it may be used.

I don't understand except that the strontium is a little more penetrating than radium, but it wouldn't seem to be such a marked difference as that; but it certainly is a major deterrent for general use to the strontium applicator. I think Dr. Hughes had that in mind in explaining about it.

Dr. Hughes brings up the question of what is, after all, the cataractogenic dose for X rays. Dr. Dreiser, here at the infirmary, and I have garnered all the cases that we could, with the help of the X-ray Department and the Dermatology Department, in which a known amount of radiation through the eye of X rays of a sufficiently penetrating caliber (that is, 100 to 200 kv.) has been administered. We have examined these patients and have found only a few cases out of 1,500 or more in which cataracts developed.

We have had two cases—Dr. Dreiser may correct me on this—which had received 800 r through the eye. Both patients have developed a posterior polar cataract which, as far as we can tell, has been stationary for some prolonged period. We have had three patients, I believe, with 600 r, who, to the best of our knowledge, have not developed cataracts; and we have had a larger group of patients receiving lesser dosages than that who have not.

So, in answer to Dr. Hughes's question, from these cases we have collected, cataractogenic doses are somewhere in the order of 1,000 r with X rays.

I would like to cite just one instance of a pathetic patient whom most of us who attend the conference have seen on occasion. It is a lady who has severe vernal catarrh, corneal ulcers, and palpebral follicles. She had received one course of beta radiation and the follicles disappeared. She was happy and so were we. About six months later the follicles returned. Dr. Shultz who had given the initial treatment, under considerable urging from her, gave her a second treatment—and again it improved, but not as much as it had the first time; subsequent to that she had a severe exacerbation, and he refused to treat her any further. So, I have been sort of leery of these dramatic responses which she had at first, lest they come back

and it is not safe to treat them again.

The question I would like to ask Dr. Hughes is—With lid follicles (not corneal follicles) where there is no danger to the lens which can't be readily avoided, when does he stop treatment?

Dr. Brendan Leahey: We have been using the beta applicator here in the office for a little over five years now; and at the present time have probably around 300 cases with probably around 1,800 treatments, total treatments. These are all with radium-D applicator. Originally, we had a 10-mc. applicator, finally we changed it—almost five years ago—to a 22-mc. one. We have not treated any deep lesions, that is, no tumors, no cysts of any sort. We have been primarily interested in eye work and corneal vascular lesions or superficial lesions.

It is obvious to any of you that there are two methods which will do the same job. The safest one is the one that we would usually choose. Apparently, in these cases we have seen, about 90 percent of them do respond to the radium D, which is more expensive than the strontium (around five or six times the expense); but it is definitely nonpenetrating—beyond two mm. there is only one percent of the surface dose. At three mm., where you may begin to hit the equator of the lens in the shallow chamber, there is practically no residual radiation; where, with the radon or with the strontium[90], you still have somewhere around 8 to 11 percent, depending on how it is measured. That isn't very much if you just have one area, but you must remember that the area of the applicator is about five mm. in diameter—5.6—and it takes four areas, if you have a completely vascularized cornea, it takes about four treatment areas to cover the whole thing. If you have, as I say, eight percent reaching the lens from one area, you will have—if you treat four different areas—a total of around 32 percent of one treatment series reaching the lens.

Besides the two cataracts that Dr. Hughes has reported, down at Hopkins last year—I am not sure whether he included those or not—a doctor from New Orleans reported three cases in the New Orleans area from strontium[90]. I don't think those have made the literature yet.

It seems to me that if the strontium[90] applicators do number 330 at the present time, we are going to have a great epidemic of cataracts in the next few years if markedly vascularized cases are treated with the strontium.

The radon has far the more efficient applicator; the radium or the strontium cannot compare with the radon applicator. Dr. Hughes has modestly held back that his radon applicator is certainly the most effective of any within the safety margin and gives off far less radiation—the total body radiation—radiation that might affect the operator. I would much rather be behind his radium applicator than any of the others for any prolonged length of time.

It is impossible to have an all-purpose applicator, the same as it is impossible to have one type of radiation of X ray that will do all jobs and take care of all tumors. So, I think the ideal thing could probably be compared to radium D for superficial lesions which are in great majority.

The ordinary ophthalmologist is not going to treat tumors, won't treat epithelial tumors; they will go to the roentgenologist who knows more about that type of thing. We are interested primarily in the corneal pathologic conditions, and we also see a great many vernal cases. I think in the vernal cases, the radium D, while it works pretty well, is not as effective.

I might answer the question just asked that there is no cure for vernal conjunctivitis except temporarily. There is no reason why these patients couldn't come back one or two years later. It isn't necessary if you have follicles more than 1.5 and 2.0 mm. in size to get a good result; it is necessary to shave those off first above the level of the conjunctiva. If you shave those off, you can start the beta right away, and it gives a very

nice result; but I think, for a margin of safety, if you confine yourself to the more superficial you would be much better off with radium D.

The cornea, of course, is only about 0.8 of a mm. thick, and we have had no trouble in removing almost complete corneal vascularization, even down almost at the back of the cornea. The main problem we have had is the chemical burns that Dr. Hughes spoke of. We have had very little luck just radiating chemical burns—sulphur dioxide, lime burns, oven burns. The treatment of them is complete resection of the surrounding conjunctiva, taking care of all the large trunks; then we go ahead and give beta radiation, starting three days later; and we have made those eyes completely avascular in quite a number of cases.

Dr. Smith: I have been using this applicator in the hospital in New York for the last six months, several times a week; we have run a series of pterygia there, for one thing. We treated some of those recurring after surgery, and some of those that had not been operated on. In the cases that were not operated, we found no results.

Our technique is to apply the radiation directly to the area. I don't know whether Dr. Hughes has any remark about the application; we are applying it just limbal, not over on the cornea, even though the pterygia extend over on the cornea. That may be a factor in the cases that were not operated. Those that were operated on, we found some decrease in the vascularization but most of them had to be redone.

The other case I would like to mention is that of a 28-year-old man who developed what appeared to be a pterygium, but in the center was a two by four mm. area that looked granulomatous. The lesion was excised and the report was squamous-cell carcinoma in the conjunctiva. We have been treating that man with a strontium^{90} beta applicator; he has been getting about 600 r, three times a week, and we contemplate three weeks' treatment. I would appreciate a comment on that.

I have not had the benefit of any research. I just read the brochure that is put out by the Tracerlab—39.5 r per second with a one-mm. depth and a four-mm. spread.

Question: I don't understand why the Atomic Energy Commission is so concerned as a national unit about the danger of a physician using a strontium^{90} applicator and not concerned over the fact that it is perfectly legal, although ethically undesirable, for anyone to buy a deep therapy machine.

Dr. Frederick Verhoeff: Is it possible that these may have a late effect—10 or 15 years later?

Dr. William F. Hughes: The last question first. I think there could be a late effect, although this applicator has been used in Baltimore since about 1939, so there is about a 15-year follow-up; and no more complications have been reported than I have told you about tonight, probably fewer. I think there is now one cataract possibly due to the radiation. At Baltimore, they do have a smaller applicator with a five-mm. aperature, whereas we have a larger one, so I think that more beta reaches the lens with our applicator probably than with theirs, but there have been no other late results reported.

I have no idea why the strontium^{90} applicator is not allowed and deep X-ray therapy is permitted, with perhaps one exception—that strontium^{90} applicator really is an experimental thing and has not been standardized either physically correctly or clinically, nor has it been accepted by the American Medical Association officially, whereas deep therapy has. So, if someone utilized deep therapy, they would be likely to know what they were getting, whereas with strontium^{90} they wouldn't accurately.

Dr. Smith asked about the treatment of squamous-cell carcinoma. The best we could do would be to estimate that our treatment of, say, six gm. sec. over a squamous-cell carcinoma would eliminate the tumor en-

tirely. It would represent a cauterizing dose that would equal 12,000 r, so, with divided doses which would be somewhat cumulative, but not entirely so, you are giving a total of 5,400 r over three weeks' time. I would think that that would be well under the dose that we have found.

The tumors are so readily visible, and even though they are carcinoma, are only locally benign; they don't even penetrate beneath bone and membrane. It would be safe, I think, to watch them under the slitlamp and clinically; and if any recurrence occurred, one would have to start again with the same dosage that one would use originally.

I believe that is a general fact of radiology —if the tumor recurs, you have to start all over again. I am inclined to push the dosage up to 12,000 rep., which really does not do too much damage to the normal ocular tissue even in one dose.

I am not sure about the question on the pterygia. We have treated pterygia over the limbal part, too, and there the corneal vascularization is thickest, the vessels are largest, and, therefore, it requires a larger dose to eliminate the vessels. It is also closer to the lens, so I don't think one gains too much by treating over the scleral part of the pterygia instead of attacking the vessels directly on the cornea.

I was interested in Dr. Leahey's results with radium D and E. Dr. Wilson used that for about six months at our place in standardizing one of the applicators, and he objected in general to the fact that the dosage output was so low that treatment times were very long; and to accomplish the objective that he wanted, to eliminate deep corneal vessels, required very long treatment times, almost impractical.

But there is no reason why not, and probably it is a good idea to treat superficial lesions with superficial radiation. As you said, only 10 percent penetrates beyond one mm. and one percent beyond two mm. so there one would have a perfectly safe radiation and it would be all right for superficial lesions.

I was very interested to hear that you can eliminate deep corneal vessels with radium D. I don't agree with your statement that if radiation was used at four different areas around the limbus, with each an eight-percent depth dose reaching the lens that there would be a total of 32 percent.

DR. BRENDAN LEAHEY: Of one area.

DR. WILLIAM F. HUGHES: Of one area reaching a certain portion of the lens. One would have 32-percent spread over the entire lens. Perhaps epithelium in any one quadrant of the lens could tolerate eight percent but no one quadrant would be able to tolerate more. I think (by geometry) perhaps not more than 10 percent, by such combined doses, would reach any one point of the lens and would be cataractogenic.

So far as the strontium^{90} applicator producing cataracts, are you certain about the New Orleans material? I understood that it was using the Iliff radium applicator in which up to 30 minutes' treatment was used.

DR. BRENDAN LEAHEY: I wouldn't swear to that. I remember at a symposium last year, somebody from New Orleans said they had three cataracts from radiation. My impression was it was strontium^{90}; it wasn't radium D.

DR. WILLIAM F. HUGHES: I think it was the radium applicator because they haven't used strontium yet as far as I know.

DR. BRENDAN LEAHEY: The radium applicator has a smaller percentage reaching the lens than strontium^{90} has, about 50 percent; that would make it even more favorable—I believe three mm. less of radium element reaching the lens than the radon or strontium^{90}, less than surface dose, I mean.

DR. WILLIAM F. HUGHES: I don't believe it is so, that less radiation, percentagewise, from the radium applicator reaches the lens than with radon.

DR. BRENDAN LEAHEY: Clem's figures were three mm. with about something like 3.9

for maybe 1.9 for radium, about one third what it was for the radon and for the strontium^{90}, but at five mm. it is about the same. Two, three, and four mm. are less in the radium element; a small percentage of surface dose reaches that area.

Dr. William F. Hughes: The radium element, per se, should filter out the soft beta, and those beta rays remaining should penetrate more deeply, so if one got an equal surface dose with the radium metal applicator as with the radon applicator, there would be a correspondingly higher percentage of gamma and a higher percentage of hard beta rays.

Concerning the last question about vernal catarrh, we more or less stop treatment when the patient is happy, but usually there is a point at which the heaviness of the lid is less noticeable, and the discharge, with the accompanying itchiness, diminishes.

We don't make any attempt to smooth off the lid completely in order to keep the dosage down to a minimum. That can usually be done, unless there are large cobblestones with a lot of hyaline material, with perhaps 15 gm. sec. or perhaps 30,000 rep. But we are not purists and idealists in that respect, and we do stop as soon as possible. That doesn't seem to eliminate recurrences, but for some strange reason the recurrences are milder.

Henry Adams Mosher,
Recorder.

NEW YORK SOCIETY FOR CLINICAL OPHTHALMOLOGY

November 2, 1953

Dr. Bernard Fread, *President*

Pathology of some macular diseases

Dr. Samuel Gartner outlined the pathology of a number of different types of macular diseases in a group of eyes obtained at autopsy at Montefiore Hospital. Clues were sought for the pathogenesis of these diseases and an attempt was made to locate the initial point of disturbance.

He said that defects of the choroidal circulation are the cause of some macular diseases and that macular cysts are probably secondary to circulatory disturbances of the choroidal and retinal vessels.

He explained that the lamina vitrea, the pigment epithelium, and each layer in the retina has its special diseases. Specimens demonstrating some of them were shown.

Dr. Norman Ashton, London, England, said that at the Institute of Ophthalmology, London, he and his colleagues, Dr. G. Serpell, D. R. Smith, Dr. B. Ward, and Dr. K. C. Wybar, had spent a considerable amount of time attempting to define the true anatomy of those structures which had been said to have a special bearing upon the genesis of ocular disease. He described some of the findings on Schlemm's canal and its interconnections, on the choroidal circulation, and on the effect of oxygen on developing retinal vessels, with particular reference to retrolental fibroplasia.

Schlemm's canal. It had long been recognized that an exact knowledge of the anatomy of Schlemm's canal was prerequisite to the proper understanding of those physiologic processes concerned with the elimination of intraocular fluids and of the pathologic changes which may adversely affect them; latterly the discovery of aqueous veins and subsequent studies on their significance in health and disease has given a new impetus to research in this field.

Dr. Ashton showed how he had demonstrated the exact anatomy of these vessels by preparing neoprene casts of the canal and its connections in eyes in which the aqueous veins had been identified with a loop suture prior to enucleation. Six laminated aqueous veins and one pure aqueous vein had been studied by this technique and it was found that all of them connected either directly or indirectly with the canal, thus confirming the supposition of Ascher that the occasional branches between the superficial and deep

scleral plexuses are the anatomic substrata of the aqueous veins.

The anatomy of the canal as revealed in over 200 neoprene casts was described and it was pointed out that the collector channels arborize so extensively in the deep scleral plexus that it is difficult to make an exact count of the exit channels. In 10 casts, however, the range was between 17 and 35 and the exit channels were usually more numerous on the nasal side in the equatorial region.

In chronic simple glaucoma, recent work indicated that there was an abnormal resistance to aqueous outflow and it had been suggested that there might be a structural impediment in the drainage system situated in the trabecular region, at the canal outlets, or in the superficial veins which finally conduct the intraocular fluid away. Examination of cast preparations showed that there was normally a narrowing in the caliber of the varicose vessels of the deep scleral plexus at the point where they emerge from the sclera to join the episcleral vessels.

It was suggested that this was a likely site of obstruction in chronic simple glaucoma and several injected specimens showed a failure to fill at this point, but it was necessary to study casts from cases in which the clinical history was known before any final conclusions could be reached.

Dr. Ashton showed that another striking feature of these communicating vessels was the obliquity of their course through the sclera and he thought that the paradox of a decrease in aqueous flow in association with an increased ocular tension, as may be demonstrated in the backflow phenomenon of Kleinert, might be due to a mechanical compression of the vessels in their intrascleral course.

By using a dual injection technique in which two different colored neoprenes were employed, it had been possible to demonstrate the arterial relationships of Schlemm's canal. Fourteen casts prepared by this method had shown the close association of arteries with the canal; they arose from the superficial and deep terminal divisions of the anterior ciliary arteries and, running right up to the canal, they anastomosed with each other to form an incomplete circle adjacent to it. No arteries entered the canal or supplied it with afferent branches. These findings did not, therefore, confirm Friedenwald's report or support his hypothesis of the mechanism of aqueous flow in health and disease.

Choroidal circulation. In assessing the importance of the role played by structure in the genesis of ocular disease, the microanatomy of the choroid especially merited consideration for there were various aspects of its vascular arrangement which had long been held responsible for the pattern of disease in this tunic and in those parts of the retina which were directly dependent upon it for nutrition.

Here again the neoprene technique was of great value. The speaker demonstrated the microanatomy of the choroidal vessels in a series of photographs of choroidal casts.

In normal conditions there were no vascular connections which could be interpreted as arteriovenous anastomoses; although the arterioles and venules intimately intertwined, there was always a capillary subdivision between their ultimate junction.

The "bulbiculi" described by Kiss and Orban as being the site of arteriovenous shunts were due merely to compression of the tributaries of the vortex vein by the overlying arteries but there were no channels connecting the vessels at this point.

It is possible, however, that arteriovenous anastomoses might arise in disease where atrophy of the choriocapillaris occurs but this has not yet been demonstrated. Nor had the speaker found any evidence of a glomus-cell apparatus in an extensive histologic examination of the eye.

It was shown that a rich anastomosis between the posterior and anterior arterial groups exists at the equator of the choroid so that the location of pathologic changes to

this zone did not appear to be related to the topographic arrangement of the choroidal vessels.

Nor could localized choroidal lesions be entirely explained by postulating the occlusion of individual arteries, for there was no anatomic evidence of a segmental blood supply. Indeed, the choroid could be completely injected via a single anterior or short posterior ciliary artery. Conversely, when a single artery was severed before injection, there was no filling defect in the appropriate sector. It was suggested that some localized lesions might arise through an intrastromal leakage of blood or exudate which led to compression and obliteration of the adjacent choroidal vessels. No evidence has been found that the submacular choriocapillaris is structurally peculiar; attempts to explain selective macular diseases on these grounds appears to be ill founded.

Retrolental fibroplasia. In conclusion Dr. Ashton discussed the pathogenesis of retrolental fibroplasia, which merits inclusion in a consideration of anatomic factors in relation to disease processes in that it apparently results from a derangement in the normal process of retinal vascularization.

It is now known that the primary pathologic changes in this disease are angioblastic in nature and lead to a proliferation of endothelial cells and of vessels into the vitreous, and finally to detachment.

Among the innumerable etiologic possibilities which have been considered and investigated in the last 10 years, the role of oxygen has been particularly controversial.

Dr. Ashton and his colleagues therefore investigated the influence of varying concentrations of oxygen upon the immature retina of the kitten. In this animal, development of the retinal vessels at birth and for the following three weeks closely approximates that in the human fetus during the terminal months of intra-uterine life and, therefore, that of the premature baby.

It was found that the developing vascular complexes in the retina could be completely obliterated by exposing kittens to an atmosphere of 60 to 70-percent oxygen for five days or over and that, when the animals were transferred to air, the vessels failed to reopen adequately, hemorrhages occurred, vascularization reappeared at the disc region, and new vessels developed in the iris.

After three weeks, there was a profuse outgrowth of vessels which extended into the vitreous in small glomerular tufts—exactly as occurred in retrolental fibroplasia; in animals left for longer periods, retinal detachment developed.

Dr. Ashton felt that the conditions of hyperoxia probably extended the nutritional range of the choroid so that the developing retinal vessels lost their growth stimulus, became redundant, and atrophied. When the kitten was returned to atmospheric conditions, the inner layers of the retina, although fully alive and in a state of active metabolism, were then without a blood supply. There was, therefore, a very great stimulus for neovascularization, which might, in fact, be due to an accumulation of metabolites, and an abnormally excessive growth of vessels advanced widely from the disc.

Abnormal vascular proliferations in the retina were also produced by subjecting kittens to an atmosphere of 10 to 15-percent oxygen. Longer periods were necessary, however, and no extensions into the vitreous had as yet been produced. The present evidence was in favor of regarding anoxia or hypoxia as the stimulus to vascular budding and the findings were of great significance in considering the etiology of retrolental fibroplasia.

It did not follow that abnormal proliferations in the premature baby occurred exactly as in the kitten, but Dr. Ashton believed that high concentrations of oxygen, by obliterating the vessels and inducing retinal ischemia, were probably responsible for the majority of cases of retrolental fibroplasia, while those occasional cases which had not been subjected to oxygen therapy and the rare prenatal form of the disease might be due to similar vascu-

lar aberrations consequent, perhaps, upon prolonged anoxia from fetal or maternal causes.

Further experiments were required to elucidate the nature of the vasoformative stimulus but it is now clear that the uncontrolled employment of oxygen in the treatment of the premature baby is extremely dangerous, in that it could destroy normal retinal vascularization. Oxygen should be given in the minimum quantity and for the shortest possible period consistent with the infant's survival.

December 7, 1953

The Mark J. Schoenberg Memorial Lecture was presented by Dr. Alan C. Woods, Wilmer Ophthalmological Institute of The Johns Hopkins University and Hospital, Baltimore.

DIAGNOSTIC PROBLEM IN UVEITIS

DR. ALAN C. WOODS said that endogenous uveitis is defined as the nonpurulent inflammation of the uveal tract associated with systemic disease or disorders. He excluded from this group all septic inflammations and all inflammatory, degenerative, or hemorrhagic lesions arising from a local or vascular cause.

Much of the present confusion on the etiology, pathogenesis and classification of uveitis appears to stem from (1) lack of a uniform terminology and a needlessly technical terminology, (2) confusion on the nature of the hypersensitive reaction, and (3) too little attention being paid to fundamental pathologic concepts. The old concept of granulomatous and nongranulomatous inflammation can be applied to endogenous uveitis and clarifies this confusion.

Granulomatous uveitis, with exception of comparatively rare cases due to certain dead organisms and inert inorganic material, is predicted as due to the presence of the living causative organism in the uveal lesions. Thus it may be classified as due to (1) nonpurulent micro-organisms pathogenic for man, (2) filterable viruses, (3) protozoan infections, (4) fungus infections, (5) helminthiasis, (6) inert foreign bodies, (7) to unknown agents. Dr. Woods presented certain points on the pathogenesis of the various subdivisions in these six groups, and reviewed the evidence which supports the hypothesis that these lesions are due to the invasion of the tissues by the living causative organisms.

Dr. Woods discussed the relative importance of the various etiologic factors in granulomatous uveitis and presented the results of three etiologic surveys made in the Wilmer Institute in 1941, 1944, and 1953. These illustrate the gradual increase in knowledge of the etiology of uveitis and the change in views which follows consideration of brucellosis, sarcoidosis and, more recently, of toxoplasmosis as etiologic factors.

Nongranulomatous uveitis is predicated to be sterile reaction due to acute insult. The insult may be physical, toxic, or allergic. Only the toxic and allergic insults are concerned in the etiology of endogenous nongranulomatous uveitis.

The history of the hypothesis that absorption of toxins may produce an endogenous uveitis was briefly reviewed and the inadequacy of such a theory was pointed out. The rise of the theory that nongranulomatous uveitis is usually a hypersensitive reaction dependent on a bacterial type of hypersensitivity was outlined.

The differences between anaphylactic and bacterial hypersensitivity were mentioned and the experimental, bacteriologic, and immunologic evidence which supports the original hypothesis work was reviewed and summarized. Under bacteriologic evidence the work of Amsler, Verrey, and the Swiss School was considered together with the somewhat different results obtained by various American observers and especially by von Sallmann and his associates. The present status of knowledge was evaluated.

Under the heading of immunologic evidence the importance of the streptococci in the underlying hypersensitivity was emphas-

sized, and the evidence of prior streptococcal infections, the presence of a specific streptococcus hypersensitivity, and the effect of specific desensitization were summarized.

Finally, the important points in the differential diagnosis between granulomatous and nongranulomatous uveitis were discussed. It was stressed that frequently in granulomatous uveitis there may be a superimposed nongranulomatous reaction, and the difficulty in differential diagnosis when this occurs was described. The similarity in the clinical and histologic picture in the end-stages of the burned-out granulomatous and nongranulomatous uveitis and the reasons therefore were discussed.

Bernard Kronenberg,
Recording Secretary.

Ophthalmic Miniature

Among the 340 patients, each of whom was individually inspected, were to be found cases of Ophthalmia or its results in all stages, from those recently affected either with simple conjunctivitis, muco-purulent Ophthalmia, or the more violent and purulent form of the disease, to those presenting collapsed globes, or staphyloma, either of the cornea and iris, or of the entire eye; but the vast majority laboured under chronic Ophthalmia with granular lids, and a great many presented ulcers of the cornea, some of which had just penetrated, thus allowing a small portion of the iris to protrude. The granulations upon the conjunctival surface of the upper lid were the largest I ever witnessed, many of them exceeding in magnitude the size of a split pea, and some resembled the protuberance which forms upon the end of the divided muscle after the operation for strabismus; or were like the little fungus nail-headed excrescence, which grows from the conjunctiva of the lid in cases of neglected tarsal tumour, attached by a peduncle, and capable of being removed with facility by means of a curved scissors.

W. R. Wilde,
"On the Epidemic of Ophthalmia which has prevailed in the workhouses and schools of the Tipperary and Athlone Unions,"
London Journal of Medicine, 1851.

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UNMASKED

In the January, 1951, issue of *The Southern Optometrist,* there appeared an editorial called "An offensive for optometry." Among other things, in this polemic, it was stated . . . "we believe that medicine has no more professional or moral right in the field of refraction than optometry has in the field of medicine. We believe the time has arisen for optometry to step out of a defensive position into an offensive position and remain so until the field of non-pathological eye care is relinquished by medicine and assumed in its full scope by optometry. Our public relations departments should educate the public that refracting, prescribing and fitting glasses are not any part of medicine and, therefore, occupy no important position in medical education. For his professional self-respect and for the benefit of the public who receives

superior service from the optometrist, the medical man should retire from the field of refraction."

The August 7, 1952, issue of *The Optometric Weekly* quotes the Hon. E. Y. Berry, congressman from South Dakota, reading into the *Congressional Record*, "a spirited commentary on the relative rights and values of the optometric profession and the medical profession." Among other things Congressman Berry is quoted as saying: "I should like to bring about a law that would require physicians practicing optometry, that is the testing of vision and the prescribing of glasses or visual training, to receive substantially the same training in and knowledge of optometry as is required of optometry . . ."

Here, then, is some of the background of a pattern of action on the part of optometrists that, in the past, has been explained away and even disclaimed by some members of that body. This has been aptly pointed out by Henry B. Carpenter, past president of the Guild of Prescription Opticians of America, Inc., and former member of the National Inter-Professional Committee on Eye Care, in the October, 1954, issue of *Guildcraft*, which has received wide distribution.

This aggressive action on the part of some optometrists has finally received official sanction by the American Optometric Association at their 1954 congress, in a series of resolutions expertly analyzed by Mr. Carpenter in his article (*Guildcraft*, October, 1954, p. 18). The first two resolutions which have finally unmasked the underlying design read as follows:

"Whereas, throughout the years the optometry laws of the several states have granted exemptions to certain groups and classes, and

"Whereas, throughout recent years there has been an increasing tendency by untrained and unlicensed persons to encroach upon the field of optometry, and particularly in the areas of the prescribing and fitting of contact lenses and the furnishing of orthoptic services and visual training; and

"Whereas, continuances of these exemptions and encroachments are to the detriment of the public; now, therefore, be it

"Resolved, that the individual state associations are recommended to make serious study of the optometry laws prevailing in their states to the end that exemptions be restricted, limited and ultimately eliminated and that encroachments by untrained, unqualified, and unlicensed persons into the exclusive field of optometry be prevented through the established enforcement agencies in the respective states."

Here is a manifesto of great interest and considerable importance to ophthalmologists and one that cannot be brushed aside or ignored. It means that official optometry plans to seek legislation that will require an ophthalmologist to pass examinations set up by optometrists before he will be permitted to refract his patient and prescribe glasses if he wants to. It may even require the ophthalmologist to attend a school of optometry as a necessary qualification to appear for an examination.

The resolutions mean, too, that everything pertaining to vision, except medical and surgical conditions of the eye, belongs exclusively to the optometrist, and no one else. If optometry succeeds in this endeavor, it is not inconceivable to believe that in the end they will consider themselves qualified to diagnose ocular diseases, then treat the patient, and ultimately to operate upon him. In other words, seriously, is this a back door to ophthalmology?

Organized optometry has shown itself to be strong in legislation and most militant in seeking their aims. At the moment, however, it seems preposterous that doctors of medicine will be crippled in their practice by restrictive state or national legislation of this nature. Refraction and the prescribing of glasses is an integral part of ophthalmology, for a number of obvious and cogent reasons that are unnecessary to detail here.

State legislators, however, and even congressmen (witness Mr. Berry's remarks) in the past have shown themselves amenable to the pressure of organized optometry, whose lobby is most persistent, as is well known. In the past, this lobby has always meant business and has been generally successful in accomplishing its aims. These resolutions must be taken most seriously and counteraction, therefore, by organized medicine must be planned and executed.

Since most of our organizations are scientific bodies and nonpolitical, ophthalmologists have only one place to which to turn and that is to the Section on Ophthalmology, American Medical Association. Unfortunately here, too, in the past, there has been very little time set aside from scientific discussions for consideration of political problems of great importance to ophthalmology.

This issue is, however, so grave that it warrants all the time that is necessary for discussion and action through the parent body. The officers of the Section are, no doubt, aware of these optometric resolutions and probably are making plans to counteract them. If not, they should be. The issue must be pressed through to the House of Delegates for its information and definitive action.

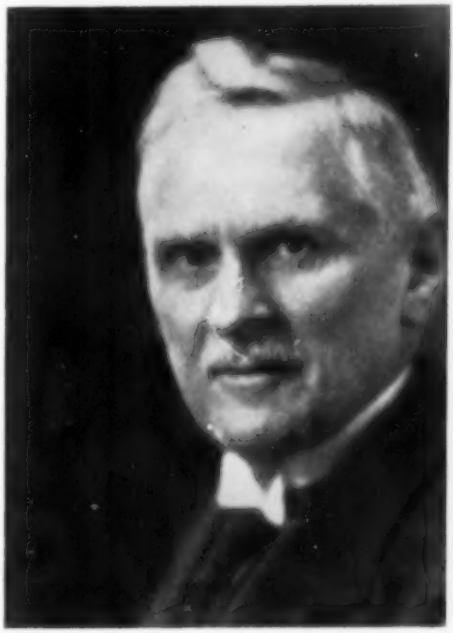
We are glad that the objectives of optometry are finally expressed for all to read and to know; for, as Mr. Carpenter says, their adoption "makes utterly impossible any disclaimer of responsibility for programs carried on pursuant to the officially declared policies." We know now where we stand.

Derrick Vail.

OBITUARIES

LOUIS DOR
(1866-1954)

I regret to say that word has been received of the death in Casablanca in October, 1954, of Louis Dor, an eminent French ophthalmologist of the old school. Born in Vevey, Switzerland, of French parentage in 1866, he returned to France for his education and medical training. His father, Henri (1834-1912), professor of ophthalmology at Berne, a pupil of von Graefe, was married to a Scottish woman. As a result, their son spoke English (as well as five other languages) fluently.



Louis Dor

Dr. Dor was graduated in medicine at Lyons in 1892 and was chief of the laboratory there for 18 years. During a short period, he was also chief of the clinic of Professor Poncet who had attained international prominence by his attendance on President Carnot when he was assassinated in Lyons in 1894.

Dr. Dor was particularly interested in problems of refraction, especially astigmatism, binocular vision, and strabismus. He was an authority on prisms and their use in ophthalmology. His studies on neuromyelitis optica were among the first to be

published on this, then unknown, disease. By rights, his name should be associated with that of Devic in this syndrome. He was also greatly interested in the pathogenesis of cataract and was among the first to be interested in the role of focal infections, particularly dental, in intraocular affections. He discussed actinomycoses if the eye and, among other writings, described a universal optotype scale made of circles and squares of different sizes. In 1898, he discussed paralysis of divergence in a classical paper (Lyon Médical). He was an excellent surgeon with many original ideas. He was a member of the council of the French Society of Ophthalmology for more than six years, and a member of numerous other ophthalmic organizations in which he took an active part.

In 1939, he removed to Casablanca and continued in active practice until a few days before his death. In the last years of his life, he served as honorary president of the young Société Marocaine d'Ophtalmologie. Although his great age prevented him from taking an active part in the meetings of this organization, he occasionally made interesting remarks on the subjects under discussion, observations drawn from his long experience and from old or rare books taken from his magnificent library, one of the best and most complete in France.

American ophthalmologists will be particularly interested in the following excerpts from Fulton's life of Harvey Cushing (page 173) published by Charles C Thomas, Springfield, Illinois, 1946:

"Through Louis Dor, the Lyons ophthalmologist, and his learned father, Henri, Harvey Cushing heard something of the difficulties of French medicine—the traditional aspects of promotions and appointments—and obtained a glimpse into the life of a Continental scholar:"

Lyons 12 October 1900 . . . Called on Dor (Louis) son of a Dr. H. Dor who married a Scottish woman and, thanks to her, L. D. talks English like a native. Very delightful, enthusiastic fellow—knew Councilman in the Engadine (I believe when C. was there with his wife). Dor is an ophthalmologist but such a one as the following description will relate. He took me to see a patient who had lost his cornea and anterior chamber from a hot iron. The man came to Dor after eight days just as the slough had separated. The lens fell out and the iris was prolapsed. Dor replaced them, covered the wound with a graft of rabbit's whole cornea which he sewed in place and covered with one of the thin glass arrangements for astigmatic eyes. I saw the man eight days after this—graft taken—slightly opaque. Probably will have vision. I suggested covering eyes of Gasserian ganglion patients in same manner—Dor laughed and said "that is not necessary if you cut the cervical sympathetic. Jaboulay always does in ganglion cases . . ."

"Further details went to his (Cushing's) father in a letter of the 15th:"

H. C. to H. K. C.:

I have just passed a most delightful evening with a Dr. Dor and his father here in Lyons. Ophthalmologists both of them. M. Dor fils beings as well Prof. Poncet's Chef du laboratoire pathologique, hence my acquaintance. He is a most interesting fellow—has done some excellent bacteriological work of permanent value—some work in comparative pathology—has a command of languages which makes me green with envy, his four or five only stop short at Russian—is an Alpine climber of note—a bibliophile—and an expert ophthalmologist if I judge aright. His father caps all this, however; but I must tell you of my curious visit. Having asked Dor to dine with me in return for some past favors he said no, you must come and take dinner with my father—and gave me the address of a place on the outskirts of Lyons where the Rhone winds around the high hill to the west of the river. It was dark, of course, when I arrived and I found a narrow, dark, cut-throat alley leading precipitously up the side of the hill. By the aid of many matches I found No. 55 and rang the bell. There were no windows, mind you, only abrupt walls, miles high with an occasional heavy portal. The large door swung open and I entered a little stone chamber containing a lamp in a niche in the wall which dimly lighted a bare flight of stone steps. I climbed these to the first landing, hoping to find a concierge. None. The same sort of little chamber as below. I went up another cold flight—another little room. Another and the same thing without sign of life. After five of these landings I began to get worried and would have retracted to consult the street number again which was not very distinct, when I was encouraged by a voice somewhat above to venture further and I finally arrived at the living part of this strange dwelling. I had merely gone up the front steps cut in the rock, heaven knows when. I have no idea what the house looks like by day but the rooms were large and irregular and full of old books and furniture and a very delightful old gentleman. He took me out on a terrace which overlooked the city and the river with its many

bridges and lights, and on the other side, behind us, was a large garden with three large terraces and a tea house and fruit trees and ivy. Imagine my sensations stumbling onto this strange abode.

We sat down to a very delicious dinner and afterwards I was as well served intellectually, for the old gentleman pulled down books on books, 15th cent. and thereabouts—Fabricius, full of original water colors; original perfect Vesalius Anatomy; Ambroise Paré; Haller, etc., etc. And I have walked home by the river wondering whether I will wake up in the morning and find it untrue.

Dr. Dor leaves a widow and two sons, the eldest of whom, E. L., is a physician who very kindly supplied me with information regarding his distinguished father, a most remarkable gentleman and scholar.

Derrick Vail.

ARTHUR JAMES BALLANTYNE
(1876-1954)

Arthur James Ballantyne

Arthur James Ballantyne was born in 1876 and was graduated M.B., Ch.B., from the University of Glasgow in 1898. He was appointed Lecturer in Ophthalmology in 1920 in succession to Dr. Maitland Ramsay and, in 1935, became the first director of The Tennent Institute of Ophthalmology and professor in the University of Glasgow. He retired a few years ago from active practice and went to live in the quiet village of Killearn where he died after a long illness on November 9, 1954.

For 50 years he made regular contributions to the clinical literature of ophthalmology and on the centenary of the discovery of the ophthalmoscope he remarked quietly that he had celebrated the jubilee of his own use of the instrument a few years before. He was a first class artist and made many beautiful sketches and paintings, particularly of fundus conditions. He was a house surgeon in the Glasgow Eye Infirmary with George Coats and together they visited continental clinics in the early part of this century. He was a friend of such well-known American ophthalmologists as George Derby and deSchweinitz. His early papers were upon injuries, ocular movements, and congenital anomalies, and he was an active teacher of general physiology until shortly before the outbreak of the first world war. He served as an ophthalmic surgeon in Salonika and the Near East in the 67th General Hospital. Just before the outbreak of World War II, the University of Glasgow gave shelter to Prof. Arnold Loewenstein. Ballantyne collaborated most happily with his exiled colleague and their joint work continued for several years after his formal retirement from active clinical work. The decade between 60 and 70 years of age proved to be one of great intellectual activity. It was during this period that his papers upon the correlation of vascular changes in the retina, brain, and kidney appeared and his work upon diabetic retinopathy gained world-wide recognition.

During the war Ballantyne became personally known to many American ophthalmologists who were stationed in the West of Scotland or who came on postgraduate visits following the cessation of hostilities. His work was recognized both at home and

abroad for the meticulous care of presentation and numerous professional honors were bestowed upon him. His unassuming kindness and quiet manner made a lasting impression upon the transient visitor. His life was devoted to maintain the highest traditions of clinical ophthalmology.

W. J. B. Riddell.

CORRESPONDENCE

"Crab's Eye"

A long-forgotten eye instrument

Editor,
American Journal of Ophthalmology:

Among the duties assigned to Junior House Surgeon at the Wills Hospital years ago was the reception of patients in the intervals between and in hours after clinics. Such service included attention to "foreign bodies." In my term of junior over 900 such cases were attended to.

In the region near the old hospital were foundries and factories, especially the Baldwin Locomotive Works, all working full blast, night and day. At that period, few if any works had established health departments with trained attendants. Many patients with "foreign bodies" had treated themselves by the use of something which they worked under the eyelids, trusting to the movement of the eye and the lids to sweep the foreign substance to the angle of the conjunctiva where it might be removed. Repeatedly a case of retention of the "helpful object" was found in which the object had become embedded in the retrotarsal folds of the conjunctiva, necessitating operative removal.

For a long time it was the custom to employ these objects as common treatment for self-help in the absence of another skillful method. The objects which I found were small, crimson and black beans of hard surface. It frequently happened that these beans scratched the cornea producing an intractable ulcer. This experience recalled to my memory, from my boyhood days, that sailors and long-distance travelers carried with them, with great care, a small-sized, reddish-brown bead which they called "crab's-eye," a lenticular body about one-half inch in diameter, from the stomach of the crab. Numerous members of my family and their connections were seafaring individuals and often were off on long voyages. Among their cherished possessions were these "crab's-eyes."

Recently there came into my possession a specimen of such methods of self-treatment in by-gone days, the gift by an aged lady, one of whose ancestors had been a Nantucket sea captain in the early years of the 19th century.

In my travels through the islands of the West Indies I saw natives wearing strings of scarlet beads as necklaces. I later learned these were beans of the Abrus Praecatorius of the genus Leguminosa, and were the same as those I had seen in the early years of my practice. These Abrus beans, when finely powdered, were used in those early years in the treatment of trachoma, acting as irritants for the absorption of the roughened lining of the eyelids. Such individual treatment with these beans and beads is recorded in standard works in the early years of the last century.

Specimens of these two bodies are in the museum of the College of Physicians of Philadelphia.

(Signed) Burton Chance,
Philadelphia, Pennsylvania.

The anatomic method of reference in ophthalmology

Editor,
American Journal of Ophthalmology:

There are a few common practices in clinical ophthalmology which make the work unnecessarily more difficult, especially for the student and the novice, though often also

for the seasoned practitioner. Somehow these practices have become established and are difficult to dislodge, though ultimately they will doubtlessly be discarded. I am going to mention here only one such practice, namely, the current method of recording visual fields both normal and defective, diplopia fields, and other charts associated with the action of the extraocular muscles by a method sometimes called physiologic, which is the exact opposite of the anatomic method.

In all branches of medicine, the parts described and referred to are those of the patient as seen by the doctor facing the patient. Right and left always refer to the patient's right and left. The right blade of the obstetric forceps is the one placed to the right of the patient, for example. In ophthalmology, the anatomic nomenclature is sometimes followed because it is not possible to do it otherwise. Thus charts showing, say, lesions of the cornea, show the cornea of the patient as he faces the examiner. A picture of a strabismic patient shows the deviation of the eye as the patient faces the examiner. But a record of the diplopia field shows the latter as it would be seen by the doctor, if he himself were the patient. Complete reversal of orientation is necessary with resulting confusion and unnecessary mental strain.

Or to cite just one other instance. Suppose the doctor sees with the ophthalmoscope a lesion in the right upper part of the right retina. The scotoma corresponding to this lesion is in the left lower part of the field. If this is charted by the anatomic method, the doctor can easily correlate the ophthalmoscopic picture with the scotoma shown on the field chart. But when the defect in the field is charted by the nonanatomic method the doctor has to reorient his thinking, perhaps visualize the lesion as it would be in his own eye, and correlate this with the field chart.

A great deal more could be written to show the awkwardness and confusion resulting from using the nonanatomic method. One can find a masterly discussion of this subject by Dr. Uribe Troncoso in the "Papers to be presented before the International Congress of Ophthalmology," Washington, D.C., April, 1922, p. 513-520. For some reason or other this subject was not acted on by that congress nor by subsequent congresses.

It may be added that, in addition to Dr. Troncoso, there have been a few brave souls who have defied all convention and presented the subject using the anatomic method. Dr. Luther C. Peter in his textbook, *The Extraocular Muscles*, Dr. M. Marquez in his several textbooks, to mention just two, use only the anatomic method throughout.

I hope to bring up the subject before the next Pan-American Congress of Ophthalmology. Dr. Troncoso and Dr. Marquez wish this matter taken up and the change officially recommended. The objections against making the change are at best trivial.

(Signed) Joseph I. Pascal,
New York.

BOOK REVIEWS

THE ANATOMY OF THE EYE AND ORBIT. By Eugene Wolff. New York, The Blakiston Company, fourth edition, 1954. 491 pages, 406 illustrations, including 52 in color, chapter bibliographies, index. Price: $15.00.

I suppose all English-speaking ophthalmologists, including the student just beginning his career in ophthalmology, are familiar with this excellent textbook, the first edition of which appeared in 1933. It was reprinted three times. The second edition appeared in 1940 and was reprinted twice. The third edition came out in 1948 and had two reprintings. And now here is the fourth edition, better than ever, with 51 more pages and over 80 additional and beautiful illustrations. When a textbook has gone through as many editions and reprintings as has this one, no further comment is

needed than merely to say, "it is very good indeed."

One is apt to think of anatomy as a static science in which few discoveries of any note remain to be made. That this is not true is evident on a close study of this fine textbook and in comparing it with its predecessors. In his preface, Dr. Wolff mentions some of these changes that he has introduced in the new edition. These comprise the discovery of the Pacchonian-like bodies in the inner wall of the canal of Schlemm, and changes and additions in the description of the limbus; the difference between the skin of the medial and lateral sides of the eyelids (of importance in the understanding of xanthelasma plaques); the optic tract; the commissure of Gudden and the lateral geniculate body (including the author's original and important studies in this field); the blood supply to the third, fourth, and sixth cranial nerves; the development of the vitreous and its normal appearance as seen with the gonioscope.

Those of us who knew Eugene Wolff, and the warmth of his family circle, will always remember him with gratitude for this privilege. His sudden death in February, 1954, at the age of 58 years, brought heavy hearts to all of his friends and the large group of his colleagues, students, and those who knew him only through this book, his *Pathology of the Eye*, and, finally, his *Diseases of the eye*. Our science has sustained a severe blow, but we are grateful that the fourth edition of his best book was in print when the blow fell. His life was full, gentle, and radiated human kindness. His works endure.

Derrick Vail.

BEHANDLUNG VON AUGENKRANKHEITEN: FÜR DEN PRAKTISCHEN ARZT. By Dr. Alfred Bangerter. Bern and Stuttgart, Medizinischer Verlag, Hans Huber, 1954. (Exclusive representative for the United States and Canada: International Medical Book Corporation, 381 Fourth Avenue, New York 16, New York.) 112 pages, illustrations and tables, index. Price: $4.00.

This little volume is the second edition of Bangerter's treatment of eye diseases for the general practitioner. It covers exactly what the title implies: It deals *only* with the treatment of eye diseases and it is intended *only* for the general practitioner. The usual textbooks on ophthalmology written for the medical student aim to cover the entire field, including anatomy, pathology, symptomatology, and treatment. For the most part the purpose is to give the student a general idea of the specialty rather than to enable him actually to treat eye diseases.

Bangerter assumes that the reader has a basic knowledge of ophthalmology. Diagnostic problems are hardly touched. Therapeutic procedures of eye diseases that can and should be undertaken by the general practitioner are presented in minute detail. Most of them involve the adnexa and the anterior section of the globe. There are instances in which the patient is likely to consult his family doctor for conditions which distinctly belong to the domain of the ophthalmologist. Frequently, the general practitioner can render valuable assistance by taking steps that are of immediate importance in preserving the function of the eye. At the same time, it is clearly stated how far he can go without detailed experience or suitable equipment.

There must be occasions when a patient would like to discuss with his family doctor certain points that may have come up during a consultation with an ophthalmologist who is more or less a stranger to him. Bangerter admirably covers such situations. Familiarity with his book should enable the family doctor to give intelligent explanations to his patients as to why and when glasses should be worn. He should be able to answer questions concerning what to expect during and after a cataract operation—yes, even to discuss the pros and cons of the Ridley lens!

He will realize more clearly why a cross-eyed child should be referred to the ophthalmologist as soon as possible. He will cooperate with the specialist by pointing out to the parents of the child the significance of the various steps undertaken for the correction of strabismus. Numerous other examples could be added to these random selections.

The idea of the book is splendidly conceived and splendidly executed. The author's approach is refreshingly original. He has a noteworthy attitude—to encourage rather than to frighten the general practitioner to carry out tasks for which he is qualified.

The arrangement of the book is most satisfactory. The print is clear; the illustrations are small in number but quite instructive. The index is very complete.

Stefan Van Wien.

Directory of Activities for the Blind in the United States and Canada. Compiled by Helga Lende. New York, American Foundation for the Blind, Inc., 1954, 10th edition. 133 pages. Price: $2.00.

Part I tabulates and summarizes the public agencies that are nationwide or primarily nationwide in scope; Part II, those of the state and local agencies for the blind. Every state is covered. There are also included the District of Columbia, Hawaii, Puerto Rico, and the Virgin Islands.

Every ophthalmologist has had, at some time or other, a need for just such a book. It has fallen to the lot of each of us, sooner or later and sometimes, unfortunately, often, when we have reached the end of a losing battle against a patient's blindness, to supplement our professional care with sympathetic advice on what to do from now on in. A lot of us have not known just where to turn or whom our patient should see. This book supplies that information and should be in the office desk, for ready reference, of each one of us. We are grateful for this directory.

Derrick Vail.

Abnormal Movements of the Face. By Samuel C. Little, M.D., University of Alabama, University of Alabama Press, 1954. Paper-bound, 70 pages, bibliography. Price: $2.00.

This monograph emphasizes the frequent involvement of the lids in almost all types of abnormal facial movements. Certain abnormal movements of the orbicularis oculi may be classified: myokymia, attributable to fatigue and emotional tension; fibrillation, associated with some degree of facial palsy; and facial hemispasm, of which two entities are distinguished dependent on a positive or negative history of a preceding facial paralysis. Blepharospasm by itself may be symptomatic, originating reflexly from trigeminal irritability; hysterical; or essential, resulting from organic nervous disease. Abnormal facial movements may be the only sign of an epileptic disorder and may then be precipitated by flicker-light stimuli.

James E. Lebensohn.

BOOKS RECEIVED FOR REVIEW

The following books have been received for review. Acknowledgement is made here because often there is a delay before a suitable review appears.

Embryology of the Human Eye. By Aeleta N. Barber, St. Louis, The C. V. Mosby Company, 1955. Price $8.75.

Viral and Rickettsial Diseases of the Skin, Eye, and Mucous Membranes of Man. By Harvey Blank, M.D., and Geoffrey Rake, M.B., B.S. (With a foreword by Donald M. Pillsbury, M.D.) Boston, Little, Brown & Company, 1955. Price: $8.50.

Two Lectures on Biomicroscopy of the Eye. By Hans Goldmann, M.D. Berne, Rösch, Vogt, & Co., 1955. Price: Not listed.

Human Physiology. By Bernardo A. Houssay, M.D., Juan T. Lewis, M.D., Oscar Orías, M.D., Eduardo Brawn-Menéndez, M.D., Enrique Hug, M.D., Virgilio G. Foglia, M.D., and Luis F. Leloir, M.D. (Translated by Juan T. Lewis, M.D., and Olive Thomas Lewis.) New York, McGraw-Hill Book Company, Inc., 1955, edition 2. Price: $12.00.

ABSTRACT DEPARTMENT

EDITED BY DR. F. HERBERT HAESSLER

Abstracts are classified under the divisions listed below. It must be remembered that any given paper may belong to several divisions of ophthalmology, although here it is mentioned only in one. Not all of the headings will necessarily be found in any one issue of the Journal.

CLASSIFICATION

1. Anatomy, embryology, and comparative ophthalmology
2. General pathology, bacteriology, immunology
3. Vegetative physiology, biochemistry, pharmacology, toxicology
4. Physiologic optics, refraction, color vision
5. Diagnosis and therapy
6. Ocular motility
7. Conjunctiva, cornea, sclera
8. Uvea, sympathetic disease, aqueous
9. Glaucoma and ocular tension
10. Crystalline lens
11. Retina and vitreous
12. Optic nerve and chiasm
13. Neuro-ophthalmology
14. Eyeball, orbit, sinuses
15. Eyelids, lacrimal apparatus
16. Tumors
17. Injuries
18. Systemic disease and parasites
19. Congenital deformities, heredity
20. Hygiene, sociology, education, and history

1

ANATOMY, EMBRYOLOGY, AND COMPARATIVE OPHTHALMOLOGY

Barber, A. N., Ronstrom, G. N., and Muelling, R. J., Jr. **Development of the visual pathway: optic chiasm.** A.M.A. Arch. Ophth. **52**:447-453, Sept., 1954.

A series of 37 plates is shown to illustrate the development of optic chiasm in man. (27 figures) G. S. Tyner.

Grignolo, Antonio. **Submicroscopic structure of ocular tissues.** Boll. d'ocul. **33**:513-652, Sept., 1954.

This excellent monograph, summarizing the investigations of the author and of numerous other investigators, contains an extensive description of the submicroscopic structures of the sclera, cornea, lens, retina, optic nerve, and vitreous body, illustrated by 49 instructive, partially original photographs, drawings and schematic sketches and rather complete bibliographies and reviewing tables. (49 figures, 473 references) K. W. Ascher.

Hilding, A. C. **Normal vitreous, its attachments and dynamics during ocular movement.** A.M.A. Arch. Ophth. **52**:497-514, Oct., 1954.

The vitreous is an anatomic unit relatively free from attachment to the retina but rather firmly anchored to underlying tissue at the ora, optic disc, macula, and lens capsule. Additional weaker attachments are present at the equator and anterior to it.

Preparations of eyes were made to study the movements of vitreous which are associated with ocular rotations. The greatest strain upon vitreous attachments with ordinary movements of the eye is in the upper temporal quadrant at the most frequent site of retinal detachment. Significant differences between movement of primary and secondary vitreous were not observed. (12 figures, 27 references) G. S. Tyner.

Wybar, Kenneth C. **Vascular anatomy of the choroid in relation to selective localization of ocular disease.** Brit. J. Ophth. **38**:513-527, Sept., 1954.

Despite the anatomic fact that the choroid consists of a dense continuous network of vessels, most of the lesions of the choroid remain surprisingly circumscribed. Several hypotheses have been put forth to explain this phenomenon but detailed study of these vessels in their natural relationships by Ashton's method

of making neoprene latex casts of choroidal vessels, sheds a new light on the pattern of the choroid and its relation to choroidal lesions. In earlier theories it was assumed that the choroidal vessels were end-arteries arranged in definite anatomic as well as physiologic sectors or wedges so that interference with function of a short posterior ciliary artery resulted in a wedge-shaped choroidal lesion. Later, it was believed that the choroid is divided into four vascular zones, namely, the equator, the periphery, the submacular and the peripapillary areas.

Studies with neoprine latex casts show that the choroidal vessels are not independent end-arteries but anastomose freely in several rings or circles. No specialized area of different vessels exists at the equator and the periphery of the choroid does not present any appreciably different vascular arrangement than the rest of that organ. It was also shown that the vascular pattern of the choroid behind the macular area differs in no way from that of the rest of the choroid. No special anatomic arrangement of the choroidal vessels was found to explain the selective localization of choroidal disease. (10 figures, 30 references) Morris Kaplan.

2

GENERAL PATHOLOGY, BACTERIOLOGY, IMMUNOLOGY

Blagojevic, Milan. **The role of allergy and of immunity in the development of experimental tuberculosis in guinea pig eyes.** Ann. d'ocul. **187**:769-792, Sept., 1954.

In two groups of guinea pigs the eyes were inoculated with virulent tubercle bacilli subconjunctivally, into the anterior chamber and into the vitreous. One group consisted of nonimmune, nonallergic control animals; the second of guinea pigs previously inoculated subcutaneously and which now had a positive tuberculin skin reaction. In the latter group, no preliminary exudative ocular reaction, suggestive of an allergic response, occurred. The incubation period was in all cases longer, the necrosis less extensive, the tendency to fibrosis greater, and neither tubercle bacilli nor caseation occurred in the regional lymphatics, as was the case with the control animals. The author concludes that, in previously infected animals, immunity can exist in the absence of a local allergic-hyperergic state. (12 figures, 50 references) John C. Locke.

Fontana, Giuseppe. **The effect of cortisone on the growth of implanted tumor in the anterior chamber.** Rassegna ital. d'ottal. **23**:257-266, July-Aug., 1954.

The author repeated his studies on the implantation of heterogenous tumor tissue into the anterior chamber of the rabbit. The adenocarcinoma of Ehrlich so implanted has no possibility of growth. Within 70 days phenomena of regression developed and finally complete resorption. The treatment with cortisone did not materially alter the results of the experiment. The anterior chamber of lower animals does not seem to lend itself to growth of foreign tumor cells but serves merely as a culture medium for a short time. (16 references) Eugene M. Blake.

Goldmann, H., and Witmer, R. **Antibodies in the aqueous.** Ophthalmologica **127**:323-329, April-May, 1954.

The authors have concerned themselves with the questions: 1. what the aqueous/serum ratio for blood-borne antibodies would be in nonspecific forms of uveitis, and 2. how much greater would this ratio have to be to permit the assumption of local, that is ocular, antibody formation. Data pertaining to the questions were obtained from horses affected with leptospirosis and uveitis.

The hemagglutinin test of Middlebrook and Dubos was applied to aqueous and serum of patients with chronic

uveitis. Five out of 75 such patients showed a significant, relative excess in specific hemagglutinins in the aqueous. This finding is considered as definite evidence of ocular tuberculous disease. The lower titers in the remaining 71 eyes do not speak against a tuberculous etiology. (1 figure, 6 tables, 6 references)

Peter C. Kronfeld.

Habegger, H. **Human toxoplasmosis: demonstration of the parasites in the intraocular tissues.** Arch. d'opht. **14**:470-488, 1954.

Habegger was able to demonstrate toxoplasma in the spinal fluid of a newborn infant of two months affected with chorioretinitis and hydrocephalus. The child's mother had a positive serological test for the disease. Aqueous obtained by puncture of the anterior chamber contained free toxoplasma. In a woman of 45 years suffering from multiple foci of chorioretinitis, parasites were found in subretinal fluid and the aqueous fixed complement in a dilution of 1:16. The author advocates examination of the aqueous as a new method of diagnosing toxoplasmosis. (7 figures, 200 references)

Phillips Thygeson.

Hattori, J. **The effect of eye tissues on the growth of some bacteria.** Acta Soc. Ophth. Japan **58**:1404-1413, Oct., 1954.

An emulsion was prepared from such ocular tissues as the cornea, sclera, lens, vitreous and uvea of rabbits' eyes. Such bacteria as Escherichia coli, Pseudomonas aeruginosa and Micrococcus pyogenes were brought in contact with the emulsion and, in a control experiment, with the saline solution. After two to three and one half hours of contact, a culture was made on an ordinary agar plate. When these bacteria had been in contact with a 10-percent lens emulsion prior to the cultivation, about six times as many colonies developed than in the control experiment. The emulsion of the sclera and the uvea also showed an accelerating action on the growth of the bacteria. The action of the aqueous, sclera and vitreous was very small or even negligible. (1 figure, 4 tables, 14 references)

Yukihiko Mitsui.

Witmer, R. **An immunologic study of experimental tuberculosis in the rabbit.** Ophthalmologica **127**:315-322, April-May, 1954.

This study is part of a systematic search, in experimental animals, for immunologic features of ocular tuberculosis that might become the basis of a diagnostic test for human ocular tuberculosis. As a first step the protein pattern in serum and primary and secondary aqueous of systemically and intraocularly infected rabbits was determined. The serum showed a slight reduction in the amount of albumins and a slight increase in the globulins. These changes were reflected in the primary aqueous of the infected eyes. As a second step the hemagglutination test of Middlebrook and Dubos (J. exp. Med. *86*:521, 1948) was applied to the aqueous and found to yield high titers in intraocularly infected rabbits. (5 figures, 7 references)

Peter C. Kronfeld.

3

VEGETATIVE PHYSIOLOGY, BIOCHEMISTRY, PHARMACOLOGY, TOXICOLOGY

Abrahamson, I. A., and Hurwitz, P. **Oxyphenonium (Antrenyl), a substitute for atropine.** A.M.A. Arch. Ophth. **52**:519-523, Oct., 1954.

In a large clinical series the authors found Antrenyl to be as effective a cycloplegic and mydriatic agent as atropine. A 5-percent buffered solution is suggested. No case of allergic reaction was noted. Its use was accompanied by a moderate burning sensation. (3 tables, 8 references)

G. S. Tyner.

Binder, R., and Binder, H. **Effect of anticoagulants on the healing of corneal wounds.** Arch. f. Ophth. **155**:337-344, 1954.

The authors compare histologically the healing of corneal wounds in normal rabbits with the healing process in animals to which either heparin or tromexan had been administered. The experimentally produced deficiency of fibrin in the second group of animals interferes with the normal closure and healing of perforating wounds produced with a Graefe knife. The regenerating corneal epithelium travels along the cut surface and forms a fistula which gradually becomes narrower but is still recognizable two weeks after the production of the corneal wound. (8 figures, 7 references) Ernst Schmerl.

Cascio, G. **Ultrasonic energy in ophthalmology. I. General outlines of physics, biology, and technical application, mainly in ophthalmology.** Boll. d'ocul. **33**:675-688, Oct., 1954.

The contents of this article are indicated in the title. (22 references)
K. W. Ascher.

Cascio, G. **Ultrasonic energy in ophthalmology. II. Amsler-Huber's fluoresceine test after ultrasonic application to the eye.** Boll. d'ocul. **33**:689-693, Oct., 1954.

Rabbits were subjected to ultrasonic treatment of their eyes. A transient increase of the permeability of the blood-aqueous barrier was observed and lasted for 24 hours or less. (1 graph)
K. W. Ascher.

Cascio, G. **Ultrasonic energy in ophthalmology. III. Intraocular pressure and ultrasonic energy.** Boll. d'ocul. **33**:694-697, Oct., 1954.

Ultrasonic applications regularly reduced intraocular pressure in ten rabbits on repeated applications (table). No effect was observed on the contralateral eye. Changes in the vitreous body and parasympathetic stimulation explained the pressure decrease. (1 table, 3 references) K. W. Ascher.

Cascio, G. **Ultrasonic energy in ophthalmology. IV. Influence of ultrasonic treatment on the repair of experimental corneal lesions.** Boll. d'ocul. **33**:698-701, Oct., 1954.

In five rabbits both eyes were operated on with a keratome to produce a perforating linear wound, in five more rabbits a superficial central trephination was performed, destroying a 5-mm. epithelial area. The average healing period of the treated eyes was prolonged 23 percent. (1 table, 1 graph, 4 references)
K. W. Ascher.

Caselli, F. **Action of dihydroergotamine on the permeability of the blood-aqueous barrier.** Boll. d'ocul. **33**:745-753, Nov., 1954.

Six rabbits, weighing about 2 kg. each, were given 0.10 mg. per kg. of D.H.E. 45 Sandoz intravenously, for six consecutive days, and the blood-aqueous barrier was studied as described by the author in this journal (31:271, May, 1952). Six others were given instillations of a 20-percent dilution of the Sandoz ampule every four hours, into the conjunctival sac, for six days; 30 minutes after the last instillation the blood-aqueous barrier was evaluated.

Intravenous administration of dyhydroergotamine 45 caused a definite decrease in the permeability of the blood-aqueous barrier which was not influenced by local administration. The difference is probably explained by the contracting action of D.H.E. 45 on the smooth muscles of the ciliary and iris vessels. (4 tables, 1 graph, 26 references) K. W. Ascher.

D'Ermo, F., and De Ferrari, G. **Electrophoretic study of the plasma proteins in patients suffering from so-called albumin-**

uric retinopathy. Boll. d'ocul. **33**:653-657, Sept., 1954.

Patients suffering from chronic glomerulonephritis with retinopathy were studied by using paper electrophoresis on their blood plasma. A decrease in albumin and a relative increase in the globulin fractions was found. Similar changes occur in patients suffering from diabetes and from hypertension without retinal disease. (2 tables, 1 graph, 12 references)

K. W. Ascher.

François, J., Rabaey, M., Wieme, R. J., and Neetens, A. **Study of the water-soluble lens proteins by electrophoresis in experimental cataract.** Ann. d'ocul. **187**:593-610, July, 1954.

In a study of experimental galactose cataracts in rats, the authors found a decrease in the total quantity of water-soluble lens proteins. The decrease affected all fractions equally, so that their relative concentrations remained more or less the same. (10 figures, 8 tables, 25 references) John C. Locke.

Giroud, A., and Martinet, M. **Alterations of the epithelium and of the lens fibers after thyroxin.** Arch. d'opht. **14**:247-258, 1954.

The authors report their experimental studies on cataract in fetal rats produced by administering thyroxin to pregnant rats from the ninth to the twentieth days of their gestational periods. The young were obtained by killing the mothers on the twenty-first day. Twenty percent had total cataracts and 6 percent incomplete cataracts. The cataracts resulted from swelling and autolysis of the lens fibers, associated with overproliferation of the lens epithelium centrally. The authors state that the mechanism of the production of the cataracts is still obscure. (11 figures, 12 references)

Phillips Thygeson.

Green, H., Capper, S. A., Bocher, C. A., and Leopold, I. H. **Effect of acetazoleamide (Diamox) on carbonic anhydrase activity of anterior uvea of the rabbit eye.** A.M.A. Arch. Ophth. **52**:758-762, Nov., 1954.

The authors suggest that the mechanism for the formation of bicarbonate ions by the ciliary body is the hydration of CO_2 mediated by carbonic anhydrase. Carbonic anhydrase in the anterior part of the uvea of the rabbit may be directly involved in the formation of the bicarbonate ions found in the aqueous. (2 figures, 1 table, 9 references) G. S. Tyner.

Harris, John E. **Pharmacology and toxicology.** A.M.A. Arch. Ophth. **52**:275-327, Aug., 1954.

The year's literature is abstracted and reviewed. Most of the references are dated 1953 but there are some from 1952 and some from 1954. (664 references)

G. S. Tyner.

Hatakeyama, Y., and Tanaka, S. **Studies on the stability of ophthalmic oil suspension of antibiotics.** Acta Soc. Ophth. Japan **58**:1636-1651, Dec., 1954.

A mixture of liquid paraffin and white vaseline in a ratio of about 75:25 is adequate as the base of a suspension of antibiotics. This base is not irritating. The suspension of antibiotics with this base is stable both in a physical and a chemical sense. A precipitation does not occur. The potency of the antibiotics can be preserved in the suspension as long as it does in the ointment of vaseline base. (8 figures, 16 tables, 15 references)

Yukihiko Mitsui.

Havener, W. H., and Falls, H. F. **Oxyphenonium (Antrenyl).** A.M.A. Arch. Ophth. **52**:515-518, Oct., 1954.

Antrenyl acts in a manner similar to atropine and in the same concentrations. Chemically it is a synthetic quaternary

ammonium salt. It is less similar in structure to atropine than is scopolamine. It may be used as a 1-percent solution in 1:5000 benzalkonium chloride in patients who are sensitive to atropine. It is made by Ciba. (1 figure, 2 tables, 2 references)

G. S. Tyner.

Havener, W. H., and Knorpp, C. T. **Differential radiophosphorus uptake of lens.** A.M.A. Arch. Ophth. **52**:831-832, Dec., 1954.

With the aid of radioactive phosphorus, rabbit lenses were examined for evidence of a posteroanterior nutrient flow. Under the conditions of this experiment, such a posteroanterior gradient could not be demonstrated to exist for phosphorus. The lens epithelium was found to absorb radioactive phosphorus to a concentration 100 times that of the rest of the lens. (1 table)

G. S. Tyner.

Jacobson, J. H., and Lincoln, M. W. **Effect of vasodilator drugs and stellate ganglion block upon the electroretinogram.** A.M.A. Arch. Ophth. **52**:917-922, Dec., 1954.

As a result of their studies the authors conclude that the sympathetic nervous system has little control over the blood flow which affects the amplitude of the ERG in normal eyes. (5 graphs, 6 tables, 4 references)

G. S. Tyner.

Koch, C. **Microscopic study of subretinal fluid.** Ophthalmologica **127**:386-395, June, 1954.

Microscopic studies were made of the viscous threads into which most samples of subretinal fluid obtained in the course of operations for retinal detachment can be drawn out. Permitted to dry on glass slides these threads show crystal formations of the type that occur in solutions containing colloids in addition to electrolytes. (11 figures, 6 references)

Peter C. Kronfeld.

Krwawicz, T., Seidler-Dymitrowska, M., and Vorbrodt, A. **Significance of the presence of vitamin C in the fixed cells of the cornea to determine their part in the active mesenchymal system.** Klinika Oczna **24**:93-98, 1954.

Using the histochemical method of determination of vitamin C in the corneal tissue, the authors found that the fixed corneal cells start accumulating vitamin C after the fourth day of preservation in paraffin. The cells appear to acquire a polyclastic characteristic at that time. A degenerative process starts in these cells after the sixth day of preservation. (2 figures, 7 references)

Sylvan Brandon.

Lepri, Giuseppe. **Vitamin C exchange in the aqueous under the influence of certain hormones.** Rassegna ital. d'ocul. **23**:340-350, July-Aug., 1954.

Lepri investigated the effect of cortisone administered subcutaneously and subconjunctivally, on the amount of ascorbic acid in the aqueous. The method used was a slight modification of that of Roe and Kuether, adapted to the aqueous humor. The administration of cortisone was not followed by any significant change in the amount of ascorbic acid, in contrast to the use of ACTH, as shown in a previous work by the author. (9 references)

Eugene M. Blake.

Magee, Alfred J. **Electromyogram of the extraocular muscles of the rabbit in situ. Evidence confirming its source.** A.M.A. Arch. Ophth. **52**:212-220, Aug., 1954.

Action potentials were recorded from the medial rectus muscle of rabbits and one human subject. Two types of activity were recognized which were not due to the action of the medial rectus, namely, activity of the orbicularis and movements of the head. A basic isoelectric line was recorded with both leads grounded. Ad-

ditions to this represent activity from other sources. (8 figures, 25 references)
G. S. Tyner.

Mikuni, M., and Ibaraki, Y. **Dilatation of retinal vessels and balance of the autonomic nervous system.** Acta Soc. Ophth. Japan **58**:1309-1313, Oct., 1954.

The authors studied the change in the fundus blood vessels caused by killikrein (Bayer) and amyl nitrite. The former was given intramuscularly and the latter by inhalation. The tonus of the autonomic nervous system was measured by means of the epinephrine, atropine and pilocarpine tests. In vagotonic individuals, only the vein of the fundus was dilated by kallikrein, and the dilatation of the vein was greater than that of the artery by amyl nitrite. The converse was true in the sympatheticotonic individuals. In some individuals both the vein and artery were dilated by kallikrein. In others the reaction to kallikrein and to amyl nitrite were contradictory. In these cases both the epinephrine and pilocarpine tests were positive and therefore these subjects were considered to have an increased tonus of both segments of the autonomic nervous system. (4 figures, 2 tables, 6 references) Yukihiko Mitsui.

Ogino, S., Mishima, K., Higuchi, M., and Fujimoto, T. **Studies on the metabolism of vitamin C in the crystalline lens.** Acta Soc. Ophth. Japan **58**:1599-1601, Nov., 1954.

Mannose was added to a lens homogenate to make a 50 mg. percent solution. The mixture was then held and shaken at 37.5° C for three hours. In guinea pigs, which usually died of scurvy in the course of one month after being fed with a vitamin C-free diet, the manifestation of scurvy was prevented to a certain extent when an extract of the mixture of mannose and lens homogenate was given. The extract did not show an antiscorbutic action, however, unless the mixture had been held and shaken at 37.5° C. The authors conclude that the lens is capable of producing vitamin C from mannose. Although this fact has been demonstrated by the authors by chemical means, they believe that the present experiment gives additional evidence. (4 figures, 1 table, 4 references) Yukihiko Mitsui.

Quintieri, C., and Falcinelli, M. **Ultrasonic action in ophthalmology.** Boll. d'ocul. **33**:702-712, Oct., 1954.

Ultrasonic energy may be used in certain cases without danger to the eye. Experimentally, anterior chamber hemorrhage, cataract, and corneal epithelial regeneration were studied. The results are said to be "modest." (15 references)
K. W. Ascher.

Radnót, M. **Gonadal hypertrophy in birds as the result of exposure to light.** Ophthalmologica **127**:422-424, June, 1954.

Confirming earlier reports from several biologists the author was able to demonstrate hypertrophy and increased function of the gonads in drakes and ducks that had been exposed to artificial light during their physiologic, nocturnal, rest period. If these exposures were repeated nightly up to a total of 200 to 300 hours, that is for 1½ to 2 months, the gonads grew to a size 10 to 40 times larger than in the control animals. No reference is made to associated changes in other organs or tissues. (2 figures, 4 references)
Peter C. Kronfeld.

Reiser, K. A., and Vorlaender, K. O. **Animal experiments on the local use of penicillin.** Klin. Monatsbl. f. Augenh. **125**:419-431, 1954.

A penicillin ointment (4,000 units per cc.) was put into the conjunctival sac of rabbits. The lids were sutured for an hour and then the penicillin concentration was determined in various ocular

tissues. This concentration could be markedly increased when a wetting agent and priscoline were added. (2 figures, 4 tables, 24 references)

Frederick C. Blodi.

von Sallmann, Ludwig. **Physiologic chemistry of the eye.** A.M.A. Arch. Ophth. **52**:604-640, Oct., 1954.

The literature for 1953 is reviewed. (162 references) G. S. Tyner.

Schlegel, H. E., and Swan, K. C. **Ocular penetration of procaine following subconjunctival injection.** A.M.A. Arch. Ophth. **52**:774-778, Nov., 1954.

Intraocular penetration of procaine after subconjunctival injections was greater in the tissues than in the aqueous. Ten minutes were required after administration to obtain maximal levels. The maximal levels in the iris were scarcely high enough to produce good anesthesia. The addition of epinephrine but not of hyaluronidase increased the penetration of the drug. (4 tables, 6 references)

G. S. Tyner.

Sigelman, S., Dohlman, C. H., and Friedenwald, J. S. **Mitotic and wound-healing activities in the rat corneal epithelium.** A.M.A. Arch. Ophth. **52**:751-757, Nov., 1954.

Various endocrine glands were removed and various hormones were administered to discover whether these factors influenced mitotic and wound-healing activities in the rat's corneal epithelium. Hypophysectomy was followed by diminution of mitotic activity, cortisone caused an increase. Heparin delayed epithelial wound-healing. Thyroidectomy, thyroxin administration, parathyroidectomy, adrenolectomy, alloxan diabetes and corticotropin administration had no effect on mitotic or wound-healing activities. (2 tables, 10 references) G. S. Tyner.

Suzuki, H. **Influence of the change in the blood components on the components of the aqueous humor. Report 1-5.** Acta Soc. Ophth. Japan **58**:1656-1661, 1675-1677, and 1709-1723, Dec., 1954.

The sugar content in the aqueous varies in the range of ±10 percent about the average in normal rabbits. In starved rabbits, however, the range becomes ±5 percent. When sugar is given to starved rabbits either by mouth or intravenously the sugar content in the serum increases first, then the sugar in the total blood and lastly that in the aqueous. However, the sugar in the aqueous decreases more slowly than that in the blood once it reaches the maximum. Suzuki discusses the role of the blood-aqueous barrier in the transmission of sugar. He adds that when a hyperglycemia is brought about by an injection of epinephrine, the sugar in the aqueous changes at the same rate as in the blood. (13 figures, 4 tables, 18 references) Yukihiko Mitsui.

Weimar, V. L., and Leopold, I. H. **Intraocular penetration of local hydrocortisone and cortisone.** A.M.A. Arch. Ophth. **52**:769-773, Nov., 1954.

Aqueous steroid levels after topical or subconjunctival administration of cortisone or hydrocortisone are reported. Cortisone penetrates better than hydrocortisone. Both agents penetrated better after removal of corneal epithelium. Amounts recovered were minute. (4 tables, 11 references) G. S. Tyner.

Wunderly, C., and Cagianut, B. **Free amino acids in the human aqueous humour.** Brit. J. Ophth. **38**:357-363, June, 1954.

The authors examined the aqueous humor of 33 patients with different ophthalmic diseases by means of two-dimensional paper chromatography. In 27 cases it was possible to ascertain the existence of free amino acids. They describe their method

in detail and present their data in tabular form. They summarize their results as follows:

The aliphatic amino acids of low molecular weight predominate, free alanine being the most abundant. In cases of fully-developed cataract, free methionine is frequently present in considerable quantities. The concentrations of free amino acids may be increased by inflammations of the anterior ocular segment, the basic group being prevalent mainly in acute cases. Comparison with blood plasma and other body fluids seems to indicate that the level of amino acids in the aqueous humor is influenced by the metabolism of the surrounding tissues. (2 figures, 5 tables, 10 references) Orwyn H. Ellis.

Yamashita, K. **Harmful effect of antibiotics introduced into the vitreous.** Acta Soc. Ophth. Japan **58**:1414-1437, Oct., 1954.

Yamashita studied the maximum dosage of antibiotics and similar substances which did not produce harmful reaction when introduced into the vitreous. In a preliminary study he found that the histologic changes in the retina and uvea became apparent not in a few days but a few weeks after the injection. The changes were cellular infiltration, degeneration and detachment in the retina and uvea. The detachment was found in any layer of the retina and uvea. The maximum concentration of the substances which did not give histological changes in the toad eye when administered into the vitreous at the dosage of 0.02 ml. was as follows: chlor- and oxy-tetracycline, chloramphenicol and carbomycin 0.5 mg./ml.; bacitracin, colistin, erythromycin and polymyxin B 5 mg./ml.; penicillin 30 mg./ml.; streptomycin and viomycin 50 mg./ml.; cortisone 0.01 percent; hyaluronidase 20,000 VU/ml.; streptokinase 50 U/ml. When the hyaluronidase was used in combination with antibiotics, histologic changes were apt to occur earlier but the degree of the changes was apt to be milder. (14 figures, 24 tables, 20 references)

Yukihiko Mitsui.

4

PHYSIOLOGIC OPTICS, REFRACTION, COLOR VISION

Allen, Donald G. **Method of checking segment position.** A.M.A. Arch. Ophth. **52**:456-457, Sept., 1954.

The position of bifocal segments in spectacle lenses can be easily checked by observing the shadow of the segment on the eye and lids as viewed with an ophthalmoscopic light. (6 figures)

G. S. Tyner.

Anderson, Albert L. **Accurate clinical means of measuring intervisual axis distance.** A.M.A. Arch. Ophth. **52**:349-352, Sept., 1954.

Inaccuracies in the estimation of the interpupillary distance (P.D.) as measured by the usual method (Viktorin's) are cited. A simple device which obviates these inaccuracies is introduced. (3 figures, 2 references) G. S. Tyner.

Armington, J. C., and Schwab, G. J. **Electroretinogram in nyctalopia.** A.M.A. Arch. Ophth. **52**:725-733, Nov., 1954.

Electroretinograms were made on patients with nyctalopia due to various causes. Myopes who complain of decreased night vision were normal. Congenitally night blind individuals with normal fundi showed only photopic components. Those with retinitis pigmentosa showed a typical subnormal extinguished variety. (7 figures, 16 references)

G. S. Tyner.

Bello, Domenico. **The importance of "exercises of orthochromatopsia" in the treatment of dichromatopsia.** Rassegna ital. d'ottal. **23**:339-345, July-Aug., 1954.

Bello explains two therapeutic pro-

cedures for the performance of the exercises described in his book "Exercises of Orthochromatopsia," which are to be used in the treatment of congenital and acquired dichromatopsia. He records the results of treatment in 38 cases, in 20 of which the defect was congenital. The best responses were seen in patients from five to thirty years of age. To obtain good results the author recommends controlling the desaturization of colors, the degree of luminosity, the time of observation, and the size of the visual angle. Several tables are offered in explanation. (14 references) Eugene M. Blake.

Ellerbrock, V. J. **Inducement of cyclofusional movements.** Am. J. Optometry **31**:553-566, Nov., 1954.

This paper describes experiments on cyclofusional amplitudes in which one ocular image of a vertical line was rotated by a dove prism. The response was measured by the subject himself by adjustment of a flashing light target superimposed near the upper and lower ends of the target line. The binocular images of the two lights were subjected to a disparity change equal to that of the two vertical line images but were found to excite no fusional movements. Therefore, the actual geometric position of the lights would indicate the rotation of each eye in response to the disparity in the two vertical line targets. As in horizontal fusional amplitudes, the eyes do lag slightly behind the stimulus until finally fusion breaks. On a vertical nylon string 1 mm. in diameter, 90 cms. long, viewed from 3 meters distance, cyclofusional amplitudes were reported as high as 20°. Amplitudes of vertical lines are higher than those of horizontal because the effect of disparity is to allow the perceived vertical line to move in a sagittal plane. Paul W. Miles.

Gafner, Frank. **The relationship between the skiascotoma of Goldmann and the isopters.** Ophthalmologica **127**:293-297, April-May, 1954.

The starting point of this study was the fact that the width of the physiologic angioscotomas which are due to shadows cast on the photo receptors by the retinal vessels, is subject to characteristic, reproducible variations under the influence of certain experimental factors. Goldmann has suggested that these variations are due to summation phenomena. For the more detailed study of such phenomena he has produced scotomas due to shadows (skiascotomas) by placing a narrow black rod in the path of the light emerging from the target projector of his perimeter. With the target in steady radial motion the examinee notices and reports its disappearance and then its reappearance. The latter is the more definite, the sharper subjective phenomenon. The width of the scotoma is expressed in time, that is seconds.

The study under review revealed the important fact that the width of the skiascotoma is the same for points located on the same isopter. The isopters, in other words, are the loci of retinal areas with equally wide skiascotomas. (2 figures) Peter C. Kronfeld.

Guth, S. K., and Eastman, A. A. **Brightness difference in seeing.** Am. J. Optometry **31**:567-577, Nov., 1954.

Instead of measuring the foot candles of light required for comfort and efficiency in a certain task, the author finds it easier to measure brightness difference. Brightness difference varies directly with the illumination, while contrast remains constant. Paul W. Miles.

Hansen, A. K. **"After-image transfer test" in anomalous retinal correspondence.** A.M.A. Arch. Ophth. **52**:369-374, Sept., 1954.

The author takes exception to the term

"transfer" of the after image as coined by Jaffe. He believes that there is no transfer of function from one eye to the other, but rather a persistent cortical impression. (3 tables, 5 references)

G. S. Tyner.

Hardy, L. H., Rand, G., and Rittler, M. C. **The H-R-R polychromatic plates.** A.M.A. Arch. Ophth. **52**:353-368, Sept., 1954.

The accuracy of classification of color blindness by means of this test and other standard tests was compared in 150 subjects with defective color vision. Comparison shows that the H-R-R plates provide a simple, accurate and practical test. (3 charts, 7 tables, 13 references)

G. S. Tyner.

Hermans, R. **The prescribing of tinted lenses.** Ann. d'ocul. **187**:619-638, July, 1954.

The author classifies tinted lenses in four categories according to their selective absorptive properties, and discusses the indications for each type of lens. (3 figures, 16 references)

John C. Locke.

Hermans, R. **The prescribing of punctal lenses.** Ann. d'ocul. **187**:639-646, July, 1954.

This is a general discussion of the evolution of modern ophthalmic lenses, in which the author gives his ideas on the indications and relative merits of various types of base curve (13 references)

John C. Locke.

Konstas, Konstentin A. **Accommodative esotropia with divergent position of rest.** Klin. Monatsbl. f. Augenh. **125**:479-482, 1954.

Two children are described who had exotropia when the eyes were at rest (for instance, with full hyperopic correction), but who showed orthophoria or esotropia corresponding to the degree of accommodation. The correct glasses produced constant orthophoria.

Frederick C. Blodi.

Levinge, M. **Value of abnormal retinal correspondence in binocular vision.** Brit. J. Ophth. **38**:332-344, June, 1954.

The double-image test appeared to show most accurately the state of retinal correspondence. Abnormal retinal correspondence of the harmonious type is the ideal adaptation, and this state may be demonstrated in many patients with anomalous correspondence. The afterimage test showed variable responses.

The synoptophore appeared to be inadequate in the diagnosis of small degrees of esotropia and it is essential to employ additional tests. More than half of the patients showed complete suppression of one image on the projection test, and the group with abnormal retinal correspondence included only 18 percent with suppression. This would indicate a more intense suppression in esotropia of a small degree. The synoptophore was diagnostically inadequate in patients with large areas of intense suppression. Such patients were more successfully investigated by other methods. The conditions necessary for the development of abnormal retinal correspondence must be youth, adaptability, a consistent angle of deviation, and perhaps the existence of some binocular function before the onset of squint.

Abnormal retinal correspondence appears to have a reasonable place in binocular vision. Patients with abnormal retinal correspondence have a greater field of vision than those who have much strabismus and lack the adaptation of anomalous correspondence.

Amblyopia is not affected by the degree of adaptation achieved; it was present equally in harmonious and unharmonious abnormal retinal correspondence. Pa-

tients with amblyopia did not demonstrate a variance of the size of the angle of anomaly, nor had the original angle of deviation any significance. There appeared to be little foundation for the view that anomalous correspondence is an unfavourable condition in surgical prognosis. There was no indication that these patients revert postoperatively to their original angle of deviation. Orthoptic treatment seems valueless in overcoming abnormal retinal correspondence. In no instance was normal correspondence successfully re-established. Abnormal retinal correspondence is a physiological part of normal binocular vision in many persons. (6 figures, 1 table, 26 references)

Orwyn H. Ellis.

Mercier, A., and Gaudin, J. **Evaluation of night vision and the possibilities of improving it.** Ann. d'ocul. **187**:975-984, Nov., 1954.

The authors report slight but definite improvement in night vision after the instillation of intermedin (melanophore hormone) solution in the eyes of air crew personnel. (9 figures)

John C. Locke.

Miller, E. F. **The nature and cause of impaired vision in the amblyopic eye of a squinter.** Am. J. Optometry **31**:615-623, Dec., 1954.

Brightness difference thresholds were tested in a haploscopic instrument in a 25-year-old student with amblyopia ex anopsia. Tests were performed upon each eye with foveal and eccentric stimulation, with thresholds on bar targets of different widths and brightnesses. In a normal eye increasing the width of the bar above 1.5 millimeters will not affect the threshold, but the limit for the amblyopic fovea came at a width of 2.5 millimeters. It was concluded that the amblyopic fovea behaves like peripheral dark-adapted normal retina where spatial summation is a potent factor.

The impaired visual acuity in amblyopia may be merely impaired brightness discrimination. Perhaps the cause may be the absence of inhibition reflexes in the defective fovea which leaves the spread of excitation unsubdued. This would not require an active suppression which is considered central.

Paul W. Miles.

Mongrain, M. R., and Butler, J. B. V. **Some aspects of reading problems in children.** Tr. Pacific Coast Oto-Ophth. Soc. **34**:163-171, May, 1953.

Two groups of children are discussed. In the first are those with aphasias who are unable to learn reading with the system of "flash" teaching. These can be helped by teaching phonetics and using kinesthetics to reinforce the visual memory.

In the second group are those with a disfunction of the neuromuscular or fusion mechanism. In these the convergence or fusional reflex is easily fatigued. Emphasis is placed on recovery of fusion after reducing an excess of base-out prism.

History taking and methods of examination are discussed. (14 references)

Robert A. Moses.

Nicati, A. F. **Trifocal lenses.** Ophthalmologica **127**:360-362, April-May, 1954.

Trifocal lenses did not become available in Europe until after the second world war. Their advantages and disadvantages are briefly discussed.

Peter C. Kronfeld.

Ogle, Kenneth N. **Basis of stereoscopic vision.** A.M.A. Arch. Ophth. **52**:197-211, Aug., 1954.

The author suggests from his experiment that there are two aspects of stereoscopic depth perception, an obligatory and facultative sense. Both are dependent upon disparate retinal images. The obligatory sense or true stereopsis necessi-

tates the simultaneous stimulation of horizontally associated disparate retinal elements. The facultative sense provides the individual with a sensation of an object being farther or nearer than the point of fixation. (6 figures, 17 references)

G. S. Tyner.

Pendse, G. S., Bhave, L. S., and Dandekar, V. M. **Refraction in relation to age and sex.** A.M.A. Arch. Ophth. **52**:404-412, Sept., 1954.

Certain interesting findings are reported from this clinical study. Hyperopia at the age of six years decreases toward the myopic side with age. The higher incidence of myopia in girls 11 to 12 years of age may be related to the changes taking place at puberty. (2 charts, 3 tables, 6 references) G. S. Tyner.

Pugh, Mary. **Foveal vision in amblyopia.** Brit. J. Ophth. **38**:321-331, June, 1954.

In this series of 150 patients the probable main site of inhibition was cortical in only about 50 percent of the cases. When the eyes were approximately straight the cortex was more likely to be the main site of inhibition. All the patients in this group had normal correspondence although 12 percent had also directional preference in visual tests.

In the remaining 50 percent of cases, cortical inhibition could be demonstrated in 52 percent of the patients who had definite abnormal correspondence, and also in 92 percent of those with an indefinite retinal correspondence. In half of the patients with marked abnormal retinal correspondence any inhibition through the cortex brought about by the stimulus of the good eye was slight. Anomalies of foveal vision were manifest in the alteration of acuity according to the direction of fixation. It was found that 76 percent of the patients with marked abnormal retinal correspondence had a deviation of more than five degrees. Directional anomalies were present in all these cases. The greater the deviation the higher was the directional preference.

The linkage between the angle of deviation, retinal correspondence, and cortical suppression suggests the probability of a local change in the photo-receptors of the fovea. (5 figures, 3 tables, 9 references) Orwyn H. Ellis.

Siebeck, R., and Klemm, O. **Fatigue phenomena in binocular vision from artificially produced dominance of one eye.** Arch. f. Ophth. **155**:413-432, 1954.

The authors produced monocular dominance in a number of subjects with the help of artificially introduced anisometropia. Fading of colors and of the black-white contrast result most strikingly after a prolonged reading test. (23 figures, 29 references) Ernst Schmerl.

Sloan, L. L., and Altman, A. **Factors involved in several tests of binocular depth perception.** A.M.A. Arch. Ophth. **52**:524-544, Oct., 1954.

Several tests were investigated to determine what particular aspects of depth perception each one is best fitted to measure. The authors' findings suggest that uniocular clues play a significant role in tests of binocular depth perception. A false finding of poor depth perception was given most frequently by the Vision Tester. Both stereopter tests gave false indication of good depth perception. Factors responsible for good depth perception are good binocular visual acuity and orthophoria. (3 figures, 11 tables, 34 references)

G. S. Tyner.

5

DIAGNOSIS AND THERAPY

Ambos, E. **A suggestion concerning corneal trephining.** Arch. f. Ophth. **155**: 345-346, 1954.

An instrument for corneal trephining is

suggested which is said to prevent the out-flow of the aqueous during surgery. The purpose is achieved by connecting the trephine with a water reservoir from which fluid can flow through the trephine under a pressure which is higher than the intraocular pressure. Thus the anterior chamber is preserved when the trephine perforates the cornea. (1 figure)

Ernst Schmerl.

Boithias, R. **Retinography in the Negro.** Arch. d'opht. **14**:584-586, 1954.

The author calls attention to the fact that the Negro fundus has been little photographed and describes some of the difficulties encountered while photographing cases at the Institute of Tropical Ophthalmology of Bamako. Among these were the difficulty of obtaining full mydriasis, and the impossibility of obtaining the full cooperation of the patient who had often just arrived from the bush. Special emphasis is given to the necessity of using a green or yellow filter in front of the light source of the camera, and to the advisability of correcting major refractive errors. Also stressed is the necessity of increasing the exposure time over the usual time required for white subjects. Six fundus photographs in black and white are included. (6 figures) P. Thygeson.

Donaldson, David D. **A new camera for medical stereophotography with special reference to the eye.** A.M.A. Arch. Ophth. **52**:564-570, Oct., 1954.

A new device for three-dimensional photography of the external eye is described. It is used in the Howe Laboratory and consists of a camera, flash lamp with cone, power supply and chin rest. (3 figures, 6 references) G. S. Tyner.

Grant, W. M., and Chandler, P. A. **An arrangement for gonioscopy during surgery.** A.M.A. Arch. Ophth. **52**:454-455, Sept., 1954.

A modification of a goniolens and a method of preventing entrance of air under the lens during surgical procedures is illustrated and described. (2 figures)

G. S. Tyner.

Hartmann, Edward. **Psychosomatic factors in the etiology of certain ocular affections.** Ann. d'ocul. **187**:865-897, Oct., 1954.

Aside from some such ocular diseases in which emotional factors are obvious (tics, hysteria) there are others in which such an etiology is not yet recognized, although it certainly exists. The emotional factor can either cause, initiate, or aggravate the ocular symptoms. The exact scope of such psychosomatic factors is still uncertain, but they should be considered in glaucoma, vascular disturbances, allergies, certain types of strabismus, and various functional manifestations for which no satisfactory organic explanation can be found (asthenopia, photophobia). (60 references) John C. Locke.

Hollenhorst, R. W., Svien, J. S., and Benoit, C. F. **Unilateral blindness occurring during anesthesia for neurosurgical operations.** A.M.A. Arch. Ophth. **52**:819-830, Dec., 1954.

Eight cases are reported in which unilateral blindness due to retinal ischemia followed a neurosurgical procedure. These cases and laboratory experiments proved that it is due to inadvertent application of pressure to the orbital contents by the face rest. The necessary modifications for safety are pictured and described. The essential changes were the widening of the crossbar on which the forehead rests, the separation of the two lateral bars, and the removal of the padding over the orbits so that the eyes would not be touched by the face rest. (6 figures, 1 table, 6 references)

G. S. Tyner.

Korff, J. **Biophthal, a new antibiotic combination.** Ophthalmologica **127**:418-422, June, 1954.

Biophthal is a combination of tyrothricin with chloromycetin, available in liquid and ointment form for topical use in ophthalmology. The author has found the combination of these two antibiotics very effective in a number of bacteriogenic external ocular diseases. (8 references)

Peter C. Kronfeld.

Lawson, C. **A quantitative comparison of the prism jump and the tangent screen method of plotting scotomata.** Am. J. Optometry **31**:639-645, Dec., 1954.

Irvine in 1944 described a method of detecting suppression or amblyopia by flipping a prism before that eye. If a point of light were made to appear double by a 1 or 2 prism diopter prism for a moment, the eye tested is not amblyopic or suppressing. Irvine mentioned that the method could be used to plot the size of a central scotoma. In the present paper, the method was used to outline the blind spots of five normal college students. There was no significant difference found. The prism-jump test may be valuable in plotting a central scotoma because it does not require a mirror device to maintain steady fixation. Paul W. Miles.

Lepri, G., and Fornaro, L. **Action of ACTH and cortisone on experimental ocular tuberculosis.** Boll. d'ocul. **33**:725-736, Nov., 1954.

Twenty-four rabbits weighing between 1800 and 2100 grams were given, intramuscularly, equal doses (0.1 cc.) of virulent human Koch bacillus suspensions; three months later, 0.2 cc. of the same type of Koch bacillus was injected into the anterior chamber after aspiration of the same amount of aqueous humor. Eight animals were given ACTH, eight cortisone, and six were kept as controls (two had succumbed to intercurrent disease). Four days before the anterior chamber injection, and after it for two months, the animals received 12 mg. of ACTH daily, divided into two doses, or 10 mg. of cortisone divided into two doses. Under ACTH treatment the rabbits lost 10 percent or more of their weight, but otherwise seemed to do well. Cortisone inhibited, to a large extent, the primary reaction to the anterior chamber injection, which was barely influenced by ACTH. The authors discuss this observation which is in disagreement with the observations of previous investigators. The final fate of the eyes was practically the same whether no treatment, cortisone, or ACTH was given. (9 figures, 19 references) K. W. Ascher.

Marconcini, E. **The importance of "stratigraphy" in lesions of the optic nerve near the orbital apex.** Arch. di ottal. **58**: 301-306, July-Aug., 1954.

A case is reported in which "stratigraphy" (probably what is termed tomography here) revealed a fracture in the region of the optic canal after ordinary X-rays failed to reveal a lesion. (1 figure, 3 references) John J. Stern.

Parret, J. **The stomatologic manifestations of Gougerot-Sjøgren's disease.** Ann. d'ocul. **187**:898-907, Oct., 1954.

Sialography, or X-ray examination of the parotid glands after lipiodol injection, is practised routinely by the author in cases of Gougerot-Sjøgren's disease and has both diagnostic and prognostic value. Abnormal findings are dilatation of Stensen's duct, diminution in number to complete absence of the terminal ducts, rigidity and dilatation of those ducts that remain, and lipiodol retention, sometimes for several months. Four main types of sialogram are recognized, depending upon the degree of development of the condition and the intensity of the destructive process in the glands. (10 figures)

John C. Locke.

Raiford, Morgan B. **Perimeter with controlled illumination and recording mecha-**

nism. A.M.A. Arch. Ophth. **52**:550-556, Oct., 1954.

An improved, light-weight perimeter utilizing magnetic targets and rheostat controlled illumination is described. (2 figures, 6 charts, 6 references)

G. S. Tyner.

Rossitto, R. M., and D'Arrigo, P. **The combination of zinc with synthetic antihistaminics in ocular therapy.** Arch. di ottal. **58**:293-300, July-Aug., 1954.

Zinc-imadazil, a proprietary preparation combining zinc sulfate with 2-phenylbenzylamino-methylimadazoline sulfate and 2-naphthylmethyl-imadazoline nitrate proved to be beneficial in 80 cases of palpebral, conjunctival and keratoconjunctival affections, particularly those caused by the diplobacillus and others due to an allergic factor. (19 references)

John J. Stern.

Schmidt, Theo. **Contact glasses for the examination of the chamber angle and the fundus with the slitlamp.** Klin. Monatsbl. f. Augenh. **125**:604-607, 1954.

Goldmann's three contact glasses are described. One glass with a mirror is used for the examination of the chamber angle. The fundus can be examined with a contact glass that incorporates a lens. The three-mirror glass enables one to examine with one contact glass the entire fundus, and the chamber angle. (5 figures, 5 references)

Frederick C. Blodi.

Stevenson, Thomas C. **Use of Strontium 90 applicator in beta ray therapy of the eye.** Tr. Pacific Coast Oto-Ophth. Soc. **34**: 115-123, May, 1953.

Strontium 90 provides a low-cost, stable source of pure beta rays. Its use in various ocular disorders is described and dosages are discussed. (15 references)

Robert A. Moses.

Thomas, C. I., Krohmer, J. S., and Storaski, J. P. **Geiger counter probe for diagnosis and localization of posterior intraocular tumors.** A.M.A. Arch. Ophth. **52**:413-414, Sept., 1954.

A specially constructed Geiger counter is introduced which permits accurate examination of the posterior segment by means of a sterilizable probe. (2 figures, 1 reference)

G. S. Tyner.

Uemura, M., and Kawashima, K. **Analysis of the corneal pulse wave.** Acta Soc. Ophth. Japan **58**:1520-1524, Nov., 1954.

Uemura and Kawashima measured the corneal pulse wave by means of their own apparatus. They first describe the design of an improved model of their apparatus. A comparison is then made of the recordings of the pulse wave obtained in normal individuals, patients with angiospasm and those with angiosclerosis. The wave forms obtained in these groups are illustrated. The area of the wave is largest in normal man and is smallest in the sclerotic patient. There is a delayed appearance of the peak in the sclerotic but not in the angiospastic patient. The authors introduce the formula $K_1 + K_2A$ to indicate the blood flow in the ophthalmic artery, where K_1 and K_2 are the constant and A is the area of the pluse wave. They call the ratio of the height of the wave to its area the clinical resistance. The clinical resistance is about 11, 10 and 8 in the angiospastic, sclerotic and normal man, respectively. (3 figures, 4 tables, 6 references)

Yukihiko Mitsui.

Vaughan, Daniel G. **The contamination of fluorescein solutions, with special reference to Pseudomonas aeruginosa (Bacillus pyocyaneus).** Tr. Pacific Coast Oto-Ophth. Soc. **34**:137-149, May, 1953.

Fifty fluorescein solutions from different sources were cultured and 27 were found to be contaminated, six of them with Ps. arruginosa. Phenylmercuric ni-

trate 1:25,000 was found to be a satisfactory preservative for fluorescein. The use of Kimura fluorescein papers and mercurochrome for corneal staining are mentioned. (2 tables, 41 references)

Robert A. Moses.

Woods, Alan C. **Pathogenesis and treatment of ocular tuberculosis.** A.M.A. Arch. Ophth. **52**:174-196, Aug., 1954.

This is an extensive article dealing with types and course of ocular tuberculosis, the influence of hypersensitivity, pathogenesis and treatment. Ocular lesions do not differ in their basic characteristics from tuberculous lesions elsewhere in the body. The principals of treatment consist of preserving and promoting tissue resistance by improving general hygienic conditions; desensitization if there is a high degree of sensitivity; and a direct chemotherapeutic attack on the tubercle bacilli.

Specific therapy consists of "a mixture of streptomycin and dihydrostreptomycin 1.0 gm. every second day; paraaminosalicylic acid 12 gm. daily; and isoniazid 300 mg. daily in divided doses. After five days the dose of isoniazid may be reduced to 150 mg. Treatment should be continued for a minimum period of 42 days, and longer if a full therapeutic response is not obtained."

With this regime, recurrences occur in 25 percent of successfully treated patients. Desensitization therapy is therefore conducted to lessen the severity of such recurrences. The Denys Bouillon Filtrate is the preparation of choice for desensitization. The initial dose is 0.1 cc. of No. 8 dilution. The dose is repeated every four days until 0.8 cc. of No. 5 dilution is reached. Therapeutic injections are given weekly. Treatment is continued until 0.5 cc. of No. 2 dilution is reached. This is considered a maintenance dose and is given weekly for two years. (13 figures, 15 references)

G. S. Tyner.

6

OCULAR MOTILITY

Bedrossian, E. Howard. **Anomalous retinal correspondence in alternating strabismus.** A.M.A. Arch. Ophth. **52**:669-682, Nov., 1954.

Abnormal retinal correspondence was a frequent finding in the author's series of patients with alternating esotropia. Abnormal retinal correspondence was a definite factor in getting a poor surgical result. Good surgical results were obtained in 96 percent of patients with normal retinal correspondence and in only 61 percent of patients with abnormal retinal correspondence. (4 tables, 18 references)

G. S. Tyner.

Björk, Åke. **Electromyographic study of conditions involving limited mobility of the eye, chiefly due to neurogenic paresis.** Brit. J. Ophth. **38**:528-544, Sept., 1954.

Electromyographic studies of ocular muscles have clarified normal and altered muscle physiology and now this procedure is also used in clinical diagnosis, especially of paresis. In the ocular muscles the action potentials are much smaller and the frequencies and recruitments are much more rapid than in other human muscles. It is of interest to note that when the eye is in the primary position, all the rectus muscles and the levator display considerable activity. When the eyes are rotated laterally, the activity in the active muscle increases greatly and although it falls appreciably in the antagonist, it does not disappear entirely.

In this report, a study was made of 24 patients with pathologic eye movements. There were 14 of typical eye palsy, 8 cases in which the etiology was obscure and 2 cases of traumatic mechanical interference with normal eye movement. In the cases of paresis it is possible to determine the extent of the paresis as well as to give rather accurate prognosis

of return of function. A definite fibrillation of contractions has been shown to occur in paresis as well as small jerkings of the eyeball which are called paretic nystagmus and which cannot be seen clinically. In the two cases of traumatic mechanical interference with motion, the electromyographic picture differs sufficiently from that obtained in paresis to serve as a valuable differentiating factor. (12 figures, 2 tables, 16 references)

Morris Kaplan.

Costenbader, F. D., and Bair, D. R. **Strabismus surgery—monocular or binocular?** A.M.A. Arch. Ophth. **52**:655-663, Nov., 1954.

On the basis of operative results obtained in a series of 665 cases of strabismus, the authors favor binocular over monocular surgery. Their opinion seems to be based primarily on the higher incidence of comitance after binocular operations. (9 tables) G. S. Tyner.

Hiroishi, M. **Studies on electro-oculogram. Part 5. Operative treatment of squint.** Acta Soc. Ophth. Japan **58**:1601-1606, Nov., 1954.

Hiroishi reports the success of the surgery in the treatment of strabismus in which the indication of the method and the dosage were determined with the aid of the electro-oculogram. The following conditions of each ocular muscle were analysed by the electro-oculogram: hypertony, hypertrophy, hypotony, hypoplasia or paresis and paralysis. It was the rule to employ advancement or recession when there was respectively, a decrease or an increase of muscle tonus. The dosage was also indicated by the oculogram. The result of Hiroishi's surgery with the oculogram was considerably superior to that of his previous work without an oculogram. He further points out some misunderstandings described in textbooks. It had been accepted in general that a convergent squint should not be overcorrected. In some of his cases of convergent squint, however, an over-correction was indicated by the oculogram with an excellent result from the surgery. This can only be done with the help of the electro-oculogram. The illustrations of the oculogram-curve are instructive. (6 figures, 2 tables, 2 references)

Yukihiko Mitsui.

Horsten, G. P. M., and Winkelman, M. E. **An optical illusion : autokinetic movement in the dark.** Ann. d'ocul. **187**:961-974, Nov., 1954.

After starting at a fixation light in a dark room, it often happens that the light appears to be in motion, even though it is stationary. This is known as autokinetic movement. Conversely, the light may give the impression of being stationary, when it is actually in motion. The authors have, for the first time, devised a means of measuring, more or less accurately, the direction, speed and amplitude of these autokinetic movements. Studies of 50 human subjects showed five different types of autokinetic response, each type being constant for any given individual. (8 figures, 8 references)

John C. Locke.

Huber, Alfred. **Miotics in the treatment of esotropia.** Ophthalmologica **127**:362-367, April-May, 1954.

Javal was apparently one of the first ophthalmologists who practiced and advocated the use of miotics in the treatment of esotropia. In his "Manuel de Strabisme" published in 1896 he explained the often beneficial action of the miotics in esotropia as being due to "involuntary augmentation of accommodation as a result of which the patient is no longer induced to converge in order to see clearly."

Huber uses the German cholinesterase inhibitor Mintacol in daily doses of one drop of the ½-percent solution at bedtime.

The most marked reductions in the angle of squint are obtained in children with high hyperopia and accommodative squint that started at the age of two or three years. Esotropia of earlier onset and associated with slight hyperopia does, as a rule, not respond to miotics. In about half of the cases of accommodative squint the miotics are more effective than the wearing of the full cycloplegic correction. Miotics may be of value in preparing the patient for orthoptic therapy or by eliminating a small residual squint after surgery (cfr. Abraham, Am. J. of Ophth. 32:233, 1949 and 35:1191, 1952). (4 references)

Peter C. Kronfeld.

Kennedy, J. R. **The correction of divergent strabismus with concave lenses.** Am. J. Optometry **31**:605-614, Dec., 1954.

This paper represents a series of about 155 patients with exophoria or exotropia treated with from 3.00 to 5.00 diopters excess minus power to stimulate convergence. In 103 cases the results were considered successful. Some of the subjects also received visual training. The minus power was considered only in those who for some reason were not candidates for surgery. In the favorable cases discomfort did not occur. Paul W. Miles.

Lyle, Donald J. **Divergence insufficiency.** A.M.A. Arch. Ophth. **52**:858-864, Dec., 1954.

Five cases of divergence insufficiency of various etiology are reported. The symptom is diplopia for distance but not for near. Versions, ductions and convergence are normal. Divergence is absent or reduced. The site of the lesion is the pons or mesencephalon. Infection, trauma, vascular disturbances, tumors and multiple sclerosis are reported as causes. Treatment consists of monocular occlusion, prisms, or surgical modification of the lateral rectus muscles. (1 figure, 23 references) G. S. Tyner.

Mackensen, G., and Harder, S. **Electric registration of ocular movements.** Arch. f. Ophth. **155**:397-412, 1954.

The authors studied the methods involved in the electric registration of ocular movements, preliminary to investigations dealing with the problem of optokinetic nystagmus. They either use instruments for electrocardiography or electroencephalography or a galvanometer. Zinc-zincsulfate or platinum electrodes transmit the potentials produced by the ocular movements to the registering instruments. Further details of the methods are found in Mowrer, Ruch and Miller (Am. J. Physiol. 114:423-428, 1936). In this study it was found that horizontal ocular movements are registered best when the exploring electrode is placed between the temporal angle of the lids and the lateral margin of the orbit. A bitemporal lead shows good proportionality between electric potential and ocular deviation. However, the potentials obtained also present some corneoretinal electric activity and differ from person to person. Therefore, a number of preliminary measurements become necessary in each individual case. (8 figures, 7 tables, 18 references) Ernst Schmerl.

Mulberger, R. D., and McDonald, P. R. **Surgical management of nonparalytic exotropia.** A.M.A. Arch. Ophth. **52**:664-668, Nov., 1954.

Because of the numerous combinations of operative procedures which are theoretically possible in the correction of nonparalytic exotropia, the authors set forth the following rules. Bilateral symmetrical surgery is usually indicated in intermittent and alternating exotropia. Bilateral recession of the external rectus muscle is indicated unless the near point of convergence is remote; if so, a bilateral resection of the internal rectus muscles is indicated. In constant exotropia a recession-resection operation on the amblyopic

eye is indicated. In postoperative exotropia a greater amount of surgery is required to correct the overcorrection than was done to produce the undesired result. (1 table, 6 references)

G. S. Tyner.

Tubis, R. A. **An evaluation of vertical divergence tests on the basis of fixation disparity.** Am. J. Optometry **31**:624-635, Dec., 1954.

The amount of hyperphoria present while peripheral fusion is permitted is considered that amount which should be prescribed for glasses. Measurement can be made by an apparatus including three projectors and polaroid filters, after the method developed by Ogle. This measurement takes account of mechanical and neuromuscular stresses present as well as the fusional innervation habitually used to counteract the divergence. The hyperphoria in the presence of fusion was found to be about 75 percent of the total hyperphoria measured in the ordinary way.

Paul W. Miles.

Westheimer, Gerald. **Eye movement responses to a horizontally moving visual stimulus.** A.M.A. Arch. Ophth. **52**:932-941, Dec., 1954.

Experiments were carried out to study the neural level concerned with direct eye-movement response to visual stimuli only. Saccadic and constant following movements were used. The latter are initiated by movement in the visual field. Movements of targets from one portion to another in the visual field bring about saccadic movements. (6 figures, 5 references) G. S. Tyner.

Westheimer, Gerald. **Mechanism of saccadic eye movements.** A.M.A. Arch. Ophth. **52**:710-724, Nov., 1954.

"Saccadic" refers to the rapid changes in position of the eyeball which are typically found between fixation pauses during reading. Studies were made on the related nervous and muscular mechanisms. It is concluded that saccadic movement is initiated as a single, unitary step by means of simultaneous changes in innervation to each of the eye muscles involved. After a movement, the globe assumes a new position in the orbit which follows a constant pattern governed by torque, friction, inertia and elasticity. (10 figures, 28 references) G. S. Tyner.

7

CONJUNCTIVA, CORNEA, SCLERA

Boase, A. J. **Case notes: Adenoma of the conjunctiva.** Brit. J. Ophth. **38**:380-382, June, 1954.

A case report of adenoma of the conjunctiva is presented in detail. The mass was excised from the conjunctiva between the cornea and plica. The histologic preparations showed epithelium of stratified squamous type covering an adenomatous tumor and separated from it by a layer of fibrous tissue infiltrated by chronic inflammatory cells. The tumor consisted of irregular alveoli lined with cubical epithelium lying in a fibrous stroma. (4 figures, 1 reference) Orwyn H. Ellis.

Breinin, G. M., and DeVoe, A. G. **Chelation of calcium with edathamil calcium-disodium in band keratopathy and corneal calcium affections.** A.M.A. Arch. Ophth. **52**:846-851, Dec., 1954.

Eight cases (10 eyes) are reported in which EDTA was successfully used to remove calcium from the cornea. A 0.01 or 0.05 M solution of edathamil calcium-sidosium (EDTA or Versene), is applied as a corneal bath by an iontoporesis cup to the deepithelialized cornea for 15 to 20 minutes. Complete clearing of the calcific components of band keratopathy results. The procedure and preparation of the solution are described in detail. (10 figures, 2 references) G. S. Tyner.

Brockhurst, R. J., Hynes, E. A., and Cogan, D. G. **Crystalline dystrophy of the cornea.** A.M.A. Arch. Ophth. **52**:458-459, Sept., 1954.

A crystalline dystrophy of the cornea consisting of fine needle-like opacities in the anterior stroma is described. (1 figure, 4 references) G. S. Tyner.

Büttner-Wobst, Wolf. **Corneal changes in stone masons.** Klin. Monatsbl. f. Augenh. **125**:572-582, 1954.

Fifteen masons were examined and nine of them had been working on stone for more than ten years. Only eight of 30 eyes had normal corneal sensitivity and only six eyes did not show any corneal scars or foreign bodies. These changes can only be appreciated with the slitlamp. The foreign bodies are small and glistening, frequently surrounded by a zone of bluish opacification. There was no decreased visual acuity and this is therefore not an occupational hazard. None of the patients had a pneumoconiosis. One eye could be examined histologically and showed a localized proliferation of connective tissue under Bowman's membrane. (9 figures, 24 references).

Frederick C. Blodi.

Davies, W. S., and Bailey, W. H. **Malignant melanoma of the cornea.** A.M.A. Arch. Ophth. **52**:923-924, Dec., 1954.

Malignant melanoma of the cornea arises from Schwannian cells of the corneal nerves or in the basal cells of the corneal epithelium. A case is reported with clinical and histopathologic findings. (4 figures, 1 reference) G. S. Tyner.

Eadie, Stella. **Primary tuberculosis of the conjunctiva treated with streptomycin and P.A.S.** Brit. J. Ophth. **38**:568-570, Sept., 1954.

A 15-year-old girl had cervical adenitis and redness of the conjunctiva on the right side, and a small mass under the right upper lid. These lesions were painless. A brother had active pulmonary tuberculosis and was being nursed at home. The patient was admitted to the hospital where a biopsy of the small conjunctival tumor revealed a typical active tuberculous follicle. A growth of tubercle bacilli was obtained in culture. Streptomycin and P.A.S. were given for eight months when she was apparently completely cured. (4 figures, 8 references)

Morris Kaplan.

Kassner, Hans. **Experiences with epidemic keratoconjunctivitis during the summer of 1953.** Klin. Monatsbl. f. Augenh. **125**:607-610, 1954.

The author reports 110 cases observed in West Germany. Vitamins C and B_{12} are recommended; they seem to clear the corneal opacities. (2 figures)

Frederick C. Blodi.

Kitagawa, E. **Experimental study of corneal transplantation in rabbits.** Acta Soc. Ophth. Japan **58**:1555-1567, Nov., 1954.

The cornea was transplanted in 24 normal rabbits. In 18 of them the graft remained transparent. A similar transplantation was made in 22 other rabbits in which a nebula of the cornea had been brought about by an injury. The graft remained clear in only 10 of the 22 animals. In 15 other rabbits a leucoma of the cornea was produced by chemicals prior to the transplantation. In none of these cases did the graft remain clear after the transplantation. A second transplantation was not usually successful. Kitagawa states, therefore, that a transparent margin of the original cornea is essential for success in grafting. In the second study of the preservability of the graft in vitro he found that the cornea must be transplanted within 24 hours after the removal of the eye. (15 figures, 5 tables, 42 references) Yukihiko Mitsui.

Landesman, R., Douglas, R. G., and Holze, E. **The bulbar conjunctival vascular bed in the toxemias of pregnancy.** Am. J. Obst. & Gynec. **68**:170-183, July, 1954.

The writers examined 100 normal pregnant women and 155 with toxemia. In normal pregnancy definite changes are noted in the arterioles, venules, and capillaries, and these become more marked during the third trimester, and in labor, and persist for a few days of the puerperium. The authors used a magnification of 50 diameters and took stroboscopic photographs; they classified spasm and ischemia in three grades, and also noted attenuation, granularity of the veins, and tortuosity of the capillaries. They found spasm in 50 percent of normal pregnant women, in 75 percent of those with mild pre-eclampsia, and in all women with severe pre-eclampsia. Ischemia was significantly more marked in hypertensives. Granularity was significantly more marked in renal disease. Tortuosity was increased in hypertension and severe pre-eclampsia. Four instances of intravascular thrombus formation were noted. The authors state that changes in the conjunctival vascular bed appear earlier and become more advanced than do those of the retina. (12 figures, 20 references)

Harry Horwich.

Lian, S. B., and Lian, O. K. **Cortisone in interstitial and Westhoff's keratitis.** Ophthalmologica **127**:414-418, June, 1954.

Interstitial keratitis in the natives of Indonesia has often responded dramatically and always very satisfactorily to topical administration of cortisone. "With cortisone the disease is cured in a much shorter time, mostly without residual scars." Westhoff's keratitis is a disease similar and probably related to Dimmer's nummular keratitis. It occurs in Indonesia in epidemics and responds very favorably to topical cortisone administration. (17 references)

Peter C. Kronfeld.

Manschot, W. A. **Progressive scleroperikeratitis.** A.M.A. Arch. Ophth. **52**:375-384, Sept., 1954.

The clinical and histologic findings in a patient with a 30-year history of inflammation of the eye are presented. The eye appeared as "an ivory-colored disc which filled the entire entrance to the orbit." The fellow eye showed evidence of long-standing inflammation of the anterior segment. The author believes the condition to be one of the collagen diseases. (6 figures, 19 references)

G. S. Tyner.

Paton, R. Townley. **Corneal transplantation.** A.M.A. Arch. Ophth. **52**:871-916, Dec., 1954.

In this extensive article 356 corneal grafts, of which 311 were penetrating and 54 lamellar, are reported. The operative technique is described and illustrated. A circular graft was used throughout and cut with a trephine. A continuous basket-type overlying suture was employed in grafts 6 mm. or less in diameter. Direct sutures were used in larger grafts. In 299 patients who were observed for two months or longer, 193 grafts remained clear. The greatest percentage of clear grafts as obtained in cases of keratoconus and Groenouw's dystrophy; the lowest percentage in Fuchs' dystrophy, adherent leucoma and a variety of traumatic and chemical burns. (12 figures, 11 tables, 19 references)

G. S. Tyner.

Portfolio, A. G. **Streptokinase-streptodornase (varidase) in treatment of corneal ulcers.** A.M.A. Arch. Ophth. **52**:557-563, Oct., 1954.

Varidase in a 1-percent methylcellulose solution applied topically every one to two hours may be a valuable adjunct to standard treatment in certain corneal ulcers in which debridement is indicated.

G. S. Tyner.

Salvi, G. L. **Electrophoretic study of the blood serum in conjunctivitis vernalis.** Boll. d'ocul. **33**:737-744, Nov., 1954.

Fourteen patients, representing both sexes, aged between 7 and 26 years, with tarsal, bulbar, or the combined form of spring catarrh, but otherwise normal, were investigated by the method of filter-paper electrophoresis. An increase of gamma globulin and a decrease of albumin was found which could not be explained by any possible general physical disturbance. These findings, together with the increased eosinophil count, increased histamin content, and low iron content of the blood, and cutaneous sensitivity tests are considered to confirm the allergic theory of spring catarrh. (1 chart, 1 table, 57 references) K. W. Ascher.

Tsutsui, J., and Takeda, S. **A statistic observation on the spontaneous cure of trachoma.** Acta Soc. Ophth. Japan **58**:1684-1689, Dec., 1954.

The authors' statistics indicate that 30 to 40 percent of trachoma is cured spontaneously in the area with 8 to 40 percent in trachoma index. In 70 percent of the cured cases there is no residual cicatrization. (1 table, 10 references)

Yukihiko Mitsui.

8

UVEA, SYMPATHETIC DISEASE, AQUEOUS

Bedell, Arthur J. **Choroidopathy.** A.M.A. Arch. Ophth. **52**:734-740, Nov., 1954.

A fundus entity, choroidopathy, is described and illustrated by fundus photographs from additional cases. The etiology and histopathology are unknown. Ophthalmoscopically the disease is "characterized by the presence of widely dispersed (although at first only close to the disc), smoky, yellow-gray areas, which increased in number and size from ⅛ to more than ½ disc diameter, varied in shape but were oftenest round or oval, and showed no visible pigment." (10 figures, 1 reference) G. S. Tyner.

Garron, L. K. **Cysts of the iris, ciliary body and retina that simulate malignant melanoma with retinal detachment.** Tr. Pacific Coast Oto-Ophth. Soc. **34**:125-136, May, 1953.

A case is presented and the subject is thoroughly discussed. Most of the intraepithelial cysts of the iris and ciliary body have been found in the lower temporal quadrant. (8 figures, 13 references)

Robert A. Moses.

Krohn, D. L., and Garrett, E. E. **Iridoschisis and keratoconus.** A.M.A. Arch. Ophth. **52**:426-432, Sept., 1954.

A case of iridoschisis occurring in a young man with keratoconus and without glaucoma is reported. (2 figures, 1 table, 19 references) G. S. Tyner.

Martin, John D. **Behçet's disease.** A.M.A. Arch. Ophth. **52**:272-274, Aug., 1954.

This case of Behçet's disease is the first reported in a native American woman. The patient had bilateral uveitis, aphthous ulcers of the mouth and vulva and thrombophlebitis of the legs. (2 figures)

G. S. Tyner.

9

GLAUCOMA AND OCULAR TENSION

Bettini, L., and Gallia, L. **Hypotony after retrobulbar novocain and adrenalin injection.** Boll. d'ocul. **33**:771-780, Nov., 1954.

In 60 eyes, some of which were glaucomatous, the effect of the injection of various combinations of novocain and adrenalin was studied. The reduction of ocular tension was about the same in all eyes, greater in glaucomatous eyes and

most marked eight minutes after injection. The best combination was 0.6 cc. of 4 percent novocain with 0.4 cc. of 0.1 percent adrenalin solution. (6 tables, 32 references) K. W. Ascher.

Breinin, G. M., and Görtz, H. **Carbonic anhydrase inhibitor acetazoleamide (diamox).** A.M.A. Arch. Ophth. **52**:333-348, Sept., 1954.

As a result of inhibition of carbonic-anhydrase by acetazoleamide (diamox), bicarbonate and sodium ions enter the aqueous in reduced amounts; there is a fall in osmotic pressure and therefore a smaller influx of water. The intraocular pressure is correspondingly reduced.

Patients with open-angle glaucoma were subjected to water provocative tests with and without diamox. The effect of diamox was to produce a normal type curve. Tonographic curves obtained before and after diamox were unchanged, indicating an absence of alteration of the outflow mechanism. These findings substantiate the stated theory of the effect of diamox. It is further believed that diamox acts locally in the ciliary body to reduce the ionic concentration because other diuretics fail to affect glaucoma when administered systemically. Final proof rests with electrolytic analysis of aqueous after diamox therapy.

Diamox appeared to be most effective in various types of secondary and acute congestive glaucoma. The necessity for prolonged medication in chronic simple glaucoma seems to be the cause of failure in this type of glaucoma. Although there was a large initial drop in tension, there was a gradual rise after a few days. This seems to be coincident with a subclinical acidosis. Complications of prolonged use of the drug were not serious. Patients complained of paresthesias of the extremities or a typical sulfonamide-type rash. Contraindications to diamox therapy are acidosis and hepatic cirrhosis. The combination of miotics and diamox is a potent therapeutic agent. (12 figures, 15 references) G. S. Tyner.

Caselli, Francesco. **The mechanism of action of the antiglaucomatous operations. Experimental investigations on the permeability of the blood-aqueous barrier in eyes having undergone various antiglaucomatous operations.** Arch. di ottal. **58**:279-291, July-Aug., 1954.

Five groups of six rabbits each were used to compare the effect of various antiglaucomatous operations with a sixth group of 20 controls. The operations involving a direct trauma to the iris (Lagrange, iridencleisis, Elliot and iridectomy) are followed by a marked increase of blood-aqueous permeability, while cyclodiathermopuncture, which affects the ciliary body indirectly, results in only a mild increase of the permeability. (2 graphs, 6 tables, 12 references) John J. Stern.

Desvignes, P., and Chardin, E. **Heredity in primary glaucoma.** Arch. d'opht. **14**:587-600, 1954.

The authors report a study of heredity in familial glaucoma and in nonfamilial glaucoma. They have obtained adequate information on 16 families and conclude from their analysis that transmission tends to be dominant, that skipped generations are rare, and that 50 percent of the individuals in the first generation tend to be affected, 25 percent in the second. They noted no sex linkage and no role of consanguinity. They describe the phenomenon of anticipation and refer to one family in which the grandfather developed glaucoma at 50 years of age, the mother at 28 years, and the son at 23 years. They noted that the defect could disappear. They conclude that in familial glaucoma the subject desirous of having children must be told of the likelihood that at least 50 percent of his offspring will be affected.

whereas in non-familial glaucoma full reassurance can be given the patient that his children will not run an increased risk of developing the disease. (17 figures, 15 references) P. Thygeson.

François, J., and Verriest, G. **Field defects in glaucoma.** Ann. d'ocul. **187**:985-1045, Nov., 1954.

Studies of some 200 visual fields in 150 cases of glaucoma showed: 1. in acute congestive glaucoma, disturbance of spatial summations and concentric contraction, associated or not with nasal depression or with elongation of the poles of the blind spot; 2. in chronic simple glaucoma, in order of frequency, arcuate scotoma, depression of a nasal quadrant, juxtacaecal scotoma, central defect and finally cuneate defect; and 3. in chronic congestive glaucoma, the same field defects as in chronic simple glaucoma. These defects, which are not specific for glaucoma, can best be explained by localization of the lesion in the optic nerve, and some of them can only be ascribed to a disturbance in the posterior part of the nerve. (42 figures, 75 references) John C. Locke.

Haas, Joseph S. **Glaucoma.** A.M.A. Arch. Ophth. **52**:946-965, Dec., 1954.

The literature for 1953-1954 is reviewed. (131 references) G. S. Tyner.

Hertz, Valdemar. **Acute hypotonia.** Brit. J. Ophth. **38**:364-368, June, 1954.

This exhaustive review of many case reports in the literature makes it clear that acute hypotony in the closed bulb can arise where detachment of the choroid only is present; this condition is probably the expression of a choroidal detachment. The author found three cases in which the hypotonia appeared at the same time as the choroidal detachment. In one case only the choroid became detached; in the others retinal detachment followed later. (32 references) Orwyn H. Ellis.

Irvine, A. Ray, Jr. **Disc changes in glaucoma.** Tr. Pacific Coast Oto-Ophth. Soc. **34**:159-161, May, 1953.

A case of partial retinal detachment with subsequent glaucoma is presented. The ganglion cells and nerve fibers of the detached portion of the retina were present, whereas in the normally placed areas they were diminished as is usual in glaucoma. It is suggested that the detachment prevented the nerve fibers and blood vessels of the retina from being sharply angulated and compressed against the scleral lip of the disc. Robert A. Moses

Kaneda, S. **Effect of retrobulbar injection of some medicaments upon the ocular tension. Part 6.** Acta Soc. Ophth. Japan **58**:1575-1579, Nov., 1954.

Kaneda studied the effect of an electric stimulation of the autonomic nerve centers in the hypothalamus on the blood pressure and the ocular tension. Normal rabbits and rabbits in which the superior cervical ganglion or ciliary ganglion had been removed were used. An electric stimulation of the sympthetic and parasympathetic zone in hypothalamus resulted in an increase and in a decrease of ocular tension respectively. These changes were, however, proportional to the changes in the blood pressure and were not necessarily the result of such factors as the removal of the ganglions mentioned above. Retrobulbar injections of procaine, epinephrine and pilocarpine also had no essential influence on these changes in the tension. Kaneda considers, therefore, that the change in the ocular tension is not a direct action of the nerve on the eye, but it is secondary to the change in the blood pressure of the system. (2 figures, 4 tables, 7 references) Yukihiko Mitsui.

Klemens, F. **The "test operation" in chronic glaucoma.** Klin. Monatsbl. f. Augenh. **125**:531-539, 1954.

This report is based on 180 trephine operations done on 90 patients. A close parallelism was observed between the operation on the first eye and that on the second eye as to flat anterior chamber, synechiae, filtering scar, intraocular pressure, hyphema and choroidal detachment. The operation on the first eye is therefore an indication as to the individual's postoperative reaction. (5 figures, 5 references) Frederick C. Blodi.

Leydhecker, Wolfgang. **The effect of homatropine upon the tension of the normal and the glaucomatous eye.** Arch. f. Ophth. **155**:386-396, 1954.

The ocular tension was taken for about two hours after instillation of a 1-percent solution of homatropine into 120 normal and 138 glaucomatous eyes. The normal eyes showed a decrease up to 9 mm. Hg Schiøtz, and an increase up to 8 mm. Hg Schiøtz. The standard deviation from the average value of this group was found to be ± 3.6 mm. Hg Schiøtz, and the conclusion is drawn that an increase in tension greater than twice the standard deviation is possibly, and an increase greater than three times the standard deviation most probably, a sign of abnormality. Of the 138 glaucomatous eyes, 78 eyes with wide angle glaucoma did not show an abnormal increase in tension whereas in 25 eyes afflicted with narrow angle glaucoma the increase in tension reached the pathologic zone. Gonioscopic studies showed that the angle of the anterior chamber was constantly blocked by the iris where a continuous rise of tension occurred. A negative result of the homatropine test seems of no diagnostic value. (9 tables, 8 references) Ernst Schmerl.

Leydhecker, Wolfgang. **The reliability of provocative tests in glaucoma.** Klin. Monatsbl. f. Augenh. **125**:539-549, 1954.

Various tests were evaluated on patients with an ocular tension below 30 mm. Hg and no preceding operation; 1,344 tests were done on 302 eyes. The most reliable tests were the subconjunctival injection of priscoline or vasculat which gave 55 to 70 percent positive results. The water-drinking test was positive in one third of the tests. The homatropine test has a high reliability in narrow-angle glaucoma. Occasionally, however, one eye may show a positive result on a less reliable test (for example, the caffeine test) and a negative result on a usually reliable test. In wide-angle glaucoma the water drinking test (if negative) should be followed by the priscoline test and the latter, if necessary, by the caffeine test. (9 tables) Frederick C. Blodi.

Maeder, G. **Perforating retrociliary diathermy.** Ophthalmologica **127**:368-371, April-May, 1954.

In a series of 51 cases presenting various types of glaucoma the author obtained remarkably good results with Castroviejo's technique of cyclodiathermy (cfr. Am. J. Ophth. 35:1035, 1952). (1 table, 11 references) Peter C. Kronfeld.

Qadeer, S. A. **Acrylic gonio-subconjunctival plates in glaucoma surgery.** Brit. J. Ophth. **38**:353-356, June, 1954.

A method of inserting a plastic plate to drain the anterior chamber is presented. Drainage canals are engraved on the plate and suture holes are provided. Good results were achieved in all 14 eyes operated upon. (6 figures, 13 references) Orwyn H. Ellis.

de Roetth, Andrew, Jr. **Effect of changes in osmotic pressure of blood on aqueous humor dynamics.** A.M.A. Arch. Ophth. **52**:571-582, Oct., 1954.

By means of Grant's tonograph and artificially changing the osmotic pressure of the blood, studies were made on the dynamics of the aqueous humor of both normal and glaucomatous eyes. Unoperated eyes with proven open-angle-type

glaucoma on which no surgery had been done were utilized. Sorbitol was chosen as the hypertonic agent to be injected intravenously. The water-drinking test was used to produce hypotonic effects.

The total rate of flow of aqueous was decreased by hypertonic fluids and increased by hypotonic ones. The facility of aqueous outflow in glaucomatous eyes was not influenced by osmotic changes in the blood. The effect of these agents was transient, about 30 to 60 minutes. Osmotic changes of the blood may play a part in the normal diurnal pressure variations. (3 figures, 5 tables, 25 references)

G. S. Tyner.

Schmidt, Ingeborg. **Diagnostic value of foveal entoptic phenomena in glaucoma.** A.M.A. Arch. Ophth. **52**:583-597, Oct., 1954.

The Maxwell spot and the Haidinger brushes are not useful as an early test for glaucoma; 45 of 51 glaucoma patients reacted normally to both tests. (2 tables, 14 references)

G. S. Tyner.

Thiel, R. **The medical treatment of primary glaucoma.** Klin. Monatsbl. f. Augenh. **125**:513-530, 1954.

This is the author's contribution to the main discussion on glaucoma at the Seventeenth International Congress in New York. In an introduction the complicated neuro-hormonal regulation of the intraocular pressure is discussed. The importance of the hypothalamus is stressed and the connections between the eye and its dorsal root which are in the optic nerve are described. The connections with the pituitary are stressed.

The first chapter deals with the local treatment of glaucoma. The direct muscle-stimulating drugs (pilocarpine, histamine), the cholinergic drugs (acetylcholine, doryl, mecholyl) and the drugs attacking cholinesterase (physostigmine, prostigmine, mintacol, DFP) are discussed. For quick action an aqueous solution, buffered and with low surface tension, should be used. To increase the duration of the effect the vehicle should be chosen with care (oily suspension, ointment). A combination of drugs may potentiate their effects.

The second therapeutic approach is through the vegetative centers of the hypothalamus. Depressing these centers may normalize increased intraocular pressure even without any local treatment. Ergotamine, barbiturates, morphine and rauwolfia are recommended. Also, the new "lytic cocktail" has been tried. Hypertonic salt solutions also have a central effect.

The third possibility is provided by ganglion-blocking drugs (hexamethonium) or injections into the ciliary ganglion (procaine). Hormonal therapy is mentioned.

Medical treatment of glaucoma can not cure the disease; it can stop its progression if the patient follows advice. A printed sheet informing the patient about the nature of the disease is of great benefit. The limitations of the medical treatment must be appreciated. It must be discontinued when it is ineffective, when the glaucoma progresses, when hypersensitivity develops or when the patient becomes too apprehensive.

This article should be read by everyone who is interested in the problem of glaucoma. It contains fifteen colored illustrations which are an example of clarity and conciseness. (14 figures)

Frederick C. Blodi.

Weekers, R., and Delmarcelle, Y. **The measurement of the rate of aqueous flow in man.** Ophthalmologica **127**:373-385, June, 1954.

In a previous communication the authors described a relatively simple fluorometric technique of estimating the rate of flow through the anterior chamber (cfr. Am. J. Ophth. 37:620, 1954). A 10-percent

fluorescein-sodium solution is administered by instillation on the evening before the test. On the day of the test the fluorescein concentration in the anterior chamber is measured in the early morning and again in the late afternoon. From these two measurements and the time interval the coefficient of flow can be calculated or read from a graph. In addition to these measurements of rate of flow the authors made measurements of the resistance of aqueous outflow (the reciprocal of Grant's coefficient of outflow) and of the pressure in the episcleral veins in a number of characteristic clinical conditions. The results of these combined measurements are reported in the paper under review. Most forms of glaucoma encountered in clinical ophthalmology are due to increased resistance to outflow combined with a normal rate of flow and normal episcleral venous pressure. Ocular hypotony, such as acute hypotony (Leber) and the hypotony in uveitis, is due to reduction in the aqueous rate of flow. Iridectomy and iridencleisis are followed by temporary reduction of the aqueous rate of flow. The lasting tension-lowering effect of these operations is due to reduction of the resistance to flow. Only cyclodiathermy functions exclusively by depression of aqueous formation. (2 graphs, 3 tables, 23 references)

Peter C. Kronfeld.

10

CRYSTALLINE LENS

Babel, J. **Histological study of the crystalline lens in fetal rubella.** Ophthalmologica **127**:333-334, April-May, 1954.

The lenses of five three to four-months old fetuses affected with rubella became available for pathological examination and showed cataractous changes identical with those reported by Cordes. (Arch. of Ophth. 42:596, 1949). (6 references)

Peter C. Kronfeld.

Binder, Rudolf. **Visible movement of fluid within a lens with complicated cataract.** Arch f. Ophth. **155**:347-349, 1954.

A case of complicated cataract in which movement of small particles could be demonstrated is described. (9 references)

Ernst Schmerl.

Goumet, Georges. **An unsuspected treatment for cataract.** Ann. d'ocul. **187**:828-829, Sept., 1954.

A 73-year-old man was advised by the author that operation would be necessary to restore sight to his right eye, in which the vision had been reduced to light projection by a mature senile cataract. Desiring to avoid surgery and ignoring his physician's advice, he chose to administer self-treatment, by massaging his lids nightly after the instillation of granulated sugar. One night, his sight suddenly became clear. Examination showed the lens luxated into the vitreous, the visual acuity to be 20/30 with plus 10.00 sphere, the ocular tension normal and the eye free of inflammation. This favorable situation has persisted. It is reasonable to assume that the repeated massaging was responsible for the dislocation but it is difficult to know what was the strength of the suspensory ligament of the lens in this man.

John C. Locke.

Hughes, W. L. **Cataract sutures.** Brit. J. Ophth. **38**:345-352, June, 1954.

The author enumerates 18 criteria for recognizing the ideal suture material. The suture coming closest to fulfilling the requirements is 6-0 mild chromic cataract gut; 6-0 plain gut and 6-0 mild chromicized gut gave about the same tissue reaction as silk. Hughes also enumerates the characteristics of proper wound closure. He describes modification of the Stallard mattress suture in a limbus-based flap. The suture is placed in the cornea parallel to the limbus; next, each end is passed through the conjunctiva, then a

deep bite is taken in the sclera. The suture emerges through the conjunctiva and is tied after the lens extraction. By this method the wound is solidly closed, the conjunctival margins are not at the global wound margin and complications have been greatly minimized. (5 figures, 3 references) Orwyn H. Ellis.

Hurlbut, W. B., and Domonkos, A. N. **Cataract and retinal detachment associated with atopic dermatitis.** A.M.A. Arch. Ophth. **52**:852-857, Dec., 1954.

In this condition, cataract may develop very rapidly and is usually bilateral. Two cases are reported and the literature is reviewed. In one case there was a retinal separation of unknown etiology. The authors believe that a warm, arid environment will improve the dermatitis disturbance in the skin. (2 figures, 14 references)
G. S. Tyner.

Jensen, Carl D. **Complications of cataract surgery.** Tr. Pacific Coast Oto-Ophth. Soc. **34**:93-103, May, 1953.

Emphasis is placed on vitreous loss as a serious complication. Factors which aid in reducing vitreous loss are versatility in surgical technique, adequate basal anesthesia, lid akinesia, topical anesthesia, akinesia of the globe, tactile pressure on the globe to soften it, adequate corneal section, and closure of the wound. These factors are discussed and 400 cases are reviewed with reference to vitreous loss and final vision. (3 tables, 2 references)
Robert A. Moses.

Lange, F. **Turgescence of the cornea after cataract extraction.** Klin. Monatsbl. f. Augenh. **125**:583-590, 1954.

Edema of the cornea was observed in a series of 712 cataract extractions. It occurred, in various degrees, in 25 eyes after an intracapsular, and in 18 eyes after an extracapsular extraction. No common cause for this edema could be found. Nine corneas were left with permanent damage, usually a bullous keratopathy. Cortisone ointment was of some value. (2 tables, 14 references) Frederick C. Blodi.

Rodriguez, Ricardo R. **Cataract formation and diabetes control in the rat.** Arch. oftal. Buenos Aires **29**:207-212, April, 1954.

Diabetes mellitus was produced experimentally in rats by means of either a subtotal pancreatectomy or an intraperitoneal injection of alloxan (100 mg. per kg. of body weight). The animals were given various diets and different amounts of insulin, and watched for the appearance of lens opacities.

This beautifully conducted study demonstrates conclusively that the frequency with which specifically diabetic cataractous changes occur is closely related to the severity of the condition, to the type of diet and to the adequacy of insulin treatment, and that it depends basically on the levels at which the glycemia is maintained. On the other hand, evidence is provided to show that the younger the animal and the higher the blood sugar content, the shorter the latent period which precedes cataract formation. (7 tables, 16 references)
A. Urrets-Zavalía, Jr.

Shank, W. R. **Monocular coexistance of anterior lenticonus, posterior keratoconus, and congenital nuclear cataracts.** Am. J. Optometry **31**:646-651, Dec., 1954.

This is an illustrated case report of the occurrence of these lesions in an 18-year-old Negro trainee. Paul W. Miles.

Smith, R. L., Fasanella, R. M., Rosenthal, E., and Hoffman, T. E. **Cortisone in lens discission and extracapsular extraction.** A.M.A. Arch. Ophth. **52**:545-549, Oct., 1954.

Cortisone given systemically does not hasten absorption of lens material after

discission or extracapsular extraction. Delayed wound healing, delayed absorption of hyphema and decreased resistance to infection are factors against the use of cortisone. (7 references) G. S. Tyner.

Villaseca, Alfredo. **Late emptying of anterior chamber and choroidal detachment in cataract operations.** A.M.A. Arch. Ophth. **52**:250-263, Aug., 1954.

The author offers an explanation for emptying of the anterior chamber in the absence of leakage through the wound or choroidal detachment. He believes it is due to anterior herniation of the vitreous through the pupil. The forward displacement of the vitreous may exert a pull on the choroid at its attachment near the ora and bring about a choroidal detachment. A mechanical detachment of the choroid can be produced in a dissected eye by making traction on the vitreous body.

The injection of air into the anterior chamber at the conclusion of the cataract operation, avoidance of strong mydriatics and the use of miotics to reduce the herniation through the pupil are suggested for treatment. (9 figures, 13 references)

G. S. Tyner.

11

RETINA AND VITREOUS

Bangerter, A. **Contribution to the therapy of retinal detachment.** Ophthalmologica **127**:346-350, April-May, 1954.

Fourteen years ago the author devised a transvitreal method of treating macular holes by electrocoagulation (Am. J. Ophth. 24:975, 1941). He now reports a series of eight cases of macular hole with retinal detachment treated successfully by retrobulbar implants of human placental or amniotic tissue. The implants were placed directly against the sclera at the posterior pole and caused a moderately severe inflammatory, tenonitis-like, reaction. Peripheral tears, when present, were treated by electrocoagulation. All patients were immobilized for 8 to 10 days. The author attributes the beneficial results to the inflammatory reaction plus immobilization. He considers the method applicable only to macular holes. (3 figures, 4 references) Peter C. Kronfeld.

Boehringer, H. R. **Lamellar scleral resection in the treatment of retinal detachment.** Ophthalmologica **127**:342-345, April-May, 1954.

This report from Amsler's clinic in Zuerich concerns 30 cases of retinal detachment belonging to the groups in which Shapland (Tr. Ophth. Soc. U. Kingdom 71:29, 1951) and Pischel (Am. J. Ophth. 36:629, 1953) consider scleral resections indicated. Of thirty operations performed by the lamellar technique six were successful in that complete reattachment occurred, attributable to the scleral resection. On the basis of their experiences the authors feel that the indications for scleral resection should be widened. (2 tables, 5 references) Peter C. Kronfeld.

Brinkerhoff, Albert J. **Retinal detachment rates in a specific group.** Tr. Pacific Coast Oto-Ophth. Soc. **34**:151-158, May, 1953.

A statistical study of retinal detachments among railroad employees was made with reference to type of occupation, age, trauma, and other factors. (3 tables, 2 references). Robert A. Moses.

Dieterlé, P. **The distinction between primary and secondary tapetoretinal degenerations by means of electroretinography.** Ophthalmologica **127**:357-359, April-May, 1954.

Diminutions to the point of abolition of the b-wave of the electroretinogram is a very early sign of true, primary retinitis pigmentosa. In cases of secondary pigmentary degeneration (due to syphilis or one of the infectious diseases of childhood,

the b-wave may be fairly well preserved despite severe loss of function. (1 figure, 6 references) Peter C. Kronfeld.

Favre, M. **Parapapillary holes causing retinal detachment.** Ophthalmologica **127**:351-354, April-May, 1954.

In two cases of inferior retinal detachment in high myopes examination of the peripapillary region with the slitlamp and Goldmann's contact lens revealed tiny retinal tears which could not be seen with any of the conventional ophthalmoscopes. In the first case the hole was discovered after one diathermic barrage operation and two scleral shortening operations had failed. Electrocoagulation of the hole by Bangerter's transvitreal method also failed to bring about any appreciable change in the extent of the detachment.

In the second case Bangerter's method was used as the primary procedure and resulted in reattachment of the retina but also in thrombosis of the upper temporal retinal vein. The latter responded well to anticoagulants. The final visual acuity was 0.15. The occurrence of retinal holes in the peripapillary region is probably related to the pulling-away of the vitreous, during the process of vitreous detachment, at the border of the area Martegiani. (1 figure, 3 references)

Peter C. Kronfeld.

Franceschetti, A., and Forni, S. **Surgical treatment of Eales' disease.** Ophthalmologica **127**:339-341, April-May, 1954.

Foci of active periphlebitis or early retinitis proliferans in cases of Eales' disease were treated by electrocoagulation applied to the overlying sclera (cfr. Verhoeff, Arch. Ophth. 40:239, 1948). Depending on whether spontaneous vitreous hemorrhages had or had not occurred before the surgical intervention, the authors called it a therapeutic or a prophylactic procedure. In four out of six eyes subjected to the therapeutic procedure the disease seems to have been brought under control in the sense that no vitreous hemorrhages have occurred during an average postoperative period of observation of one and one half years. Three of the five patients treated prophylactically have done equally well. (4 references)

Peter C. Kronfeld.

Goldman, H. **Biomicroscopy of the vitreous.** Ophthalmologica **127**:334-339, April-May, 1954.

The biomicroscopic study of the fine structural details of the posterior vitreous in the living human eye is only possible with the contact lens. The light bulb must be overloaded, the slit narrowed and the angle between microscope and illuminating system be made as large as possible. With this technique the canal of Cloquet can be traced all the way back to the papilla. (4 figures, 3 references)

Peter C. Kronfeld.

Henkes, H. E., van der Kam, J. P., and Westhoff, A. J. S. **Electroretinographic studies in arterial hypertension.** A.M.A. Arch. Ophth. **52**:221-233, Aug., 1954.

This paper deals with the influence of reduction in blood pressure on the electrical responses of the human retina as measured by the electroretinogram. The studies suggest that in hypertensive sclerosis of the retina, the hypertension is essential for the maintenance of sufficient retinal oxygenation. Sudden lowering of the blood pressure can therefore dangerously embarrass the retinal oxygenation in patients with retinal arteriolarsclerosis and atherosclerosis. (12 figures, 6 references) G. S. Tyner.

Hilding, A. C. **Alterations in the form, movement, and structure of the vitreous body in aphakic eyes.** A.M.A. Arch. Ophth. **52**:699-709, Nov., 1954.

Studies made on 100 aphakic eyes are presented. Several factors may contribute

to the higher incidence of retinal detachment in aphakic eyes. Most retinal detachments are probably not caused by major but rather by minor attachments of the vitreous to the retina. A description of some of these factors follows: 1. After intracapsular extraction the hyaloid membrane may be adherent to the posterior surface of the iris. The hyaloid membrane is then put under stress by movements of the pupil. 2. With ocular rotations, the vitreous in aphakia is subjected to increased forces of acceleration and deceleration. 3. With removal of the lens there is loss of normal support to the vitreous and retina. (7 figures, 21 references)

G. S. Tyner.

Kleinert Heinz. **Primary formation of retinal folds in the region of the macula.** Arch. f. Ophth. **155**:350-358, 1954.

Findings in six older patients (five women, one man) are presented and summarized. Stellate folding of the retina, capillary irregularities and retinal thickening within the region of the macula were observed before the patients complained of any symptoms. Several months later the patients noticed a deterioration of vision and metamorphopsia. Preretinal changes and a posterior detachment of the vitreous body became noticeable. Local vascular disturbances are considered as possible factors producing this condition. (5 figures, 4 references)

Ernst Schmerl.

Manschot, W. A. **Etiology of retrolental fibroplasia.** A.M.A. Arch. Ophth. **52**:833-845, Dec., 1954.

114 eyes of premature infants were examined histopathologically. The author believes that the disease is associated with interstitial plasma cell pneumonia. The etiology is believed to be a yeast-like fungus, Pneumocystis carinii. (6 figures, 39 references) G. S. Tyner.

Mitsui, Y., and Sakanashi, R. **A slitlamp study of chorioretinitis centralis (Masuda), a preliminary note.** Acta Soc. Ophth. Japan **58**:1322-1330, Oct., 1954.

This is a slitlamp study of the fundus in central angiospastic retinopathy which is prevalent in Japan and is known as Masuda's central chorioretinitis. Thirty cases were observed and three types were distinguished by slitlamp examination; namely, serous detachment of the retina, serofibrinous detachment of the retina and retinal edema without detachment. In the first type, the retinal beam bends forward while the pigment epithelium retains its normal position. The retinal vessels cast a shadow on the pigment epithelium. There is a clear space between the retina and pigment epithelium. There are white precipitates on the external surface of the detached retina. There are also yellow plaques in the choroid. In the second type, the space in the area of detachment looks opaque and the shadow of the vessels is obscured. In the third type, there is a turbidity in the outer layers of the retina. There is often an increased thickness of the retina due to edema, but there is no detachment. (9 figures, 1 table, 6 references) Yukihiko Mitsui.

Montagne, F. **Late action of anticoagulants associated with vasodilators on thrombosis of the retinal veins.** Arch. d'opht. **14**:601-604, 1954.

Montagne notes that anticoagulants have improved the prognosis of thrombosis of the central retinal vein and its branches, but that their success has been a reflection of the rapidity with which they have been applied. He reports two cases, however, in which success was obtained in old cases, two weeks and eight weeks respectively. In these cases the anticoagulants were combined with vasodilators, both in high dosages. The fundus changes before and after treatment of the

first case are illustrated by color drawings. (2 figures, 11 references)

P. Thygeson.

Moore, J. Gibson. **Choroidal detachment following operation for detached retina.** Brit. J. Ophth. **38**:571-572, Sept., 1954.

It is probable that choroidal detachment occurs after free drainage of the subretinal fluid during the operation for retinal detachment since the globe is in a state of hypotension. This has not been reported, probably because it passes unnoticed with the absence of examination within a short time after surgery. In a 31-year-old woman repair of retinal detachment without a tear was followed by drainage of subretinal fluid. Convalescence was uneventful except that on the seventh day two quadrants of the choroid were seen to be detached. Eight weeks later the two membranes returned to their normal position and remained in place. As an explanation of the origin of this choroidal detachment the authors rejected the idea of a rent in the chamber angle with seepage of fluid behind the choroid as very unlikely. The explanation of the detachment by O'Brien and Duke-Elder as resulting from a transudation of fluid from the choroidal veins into the perichoroidal space seems the most reasonable. (8 references)

Morris Kaplan.

Nano, H. M., and Scenna, M. A. **Angiopathia retinae traumatica (Purtscher's disease).** Arch. oftal. Buenos Aires **29**:285-290, May, 1954.

Two cases of this rare condition are described, in which an extensive, dull gray retinal edema, accompanied by multiple hemorrhages and by white, cotton-wool-like exudates appeared in one eye within a few hours after a blunt injury to the skull took place. The whole picture cleared up in the course of some weeks and vision, which had been reduced to 20/40 in one patient and to the ability of counting fingers in the other, returned to normal in both. A close relationship between this condition and Berlin's commotio retinae is held to exist and would be supported by the evidence presented. (2 figures) A. Urrets-Zavalia, Jr.

Neubauer, Hellmut. **Retinoblastoma and malformations.** Klin. Monatsbl. f. Augenh. **125**:549-560, 1954.

The author describes a 2½-year-old girl with microcephalus, dysplasia of the thumbs and anal atresia with fistula. One eye was enucleated; the girl died from metastases. (7 figures, 14 references)

Frederick C. Blodi.

Schimkat, E., and Unger, H. **A subretinal fibroma.** Klin. Monatsbl. f. Augenh. **125**:560-566, 1954.

A 59-year-old man had a macular tumor in one eye. He died from a bronchogenic carcinoma. The histologic examination of the eye revealed not a metastatic tumor as assumed, but a mass of fibrous tissue between retina and choroid which the authors call a fibroma. (5 figures, 12 references) Frederick C. Blodi.

Senà, J. A., and Jörg, M. E. **Intraocular cartilage formation in a case of retinoblastoma.** Arch. oftal. Buenos Aires **29**:271-283, May, 1954.

The left eye of a four-year-old girl had to be enucleated because of secondary glaucoma which had developed 15 months after some cataractous changes were noticed. Pathologic examination revealed an extensive retinoblastoma with abundant cartilage formation, which probably was of a hyperplastic, secondary nature. The patient died of a local recurrence and of multiple metastases after an interval of two months. (10 figures, 7 references)

A. Urrets-Zavalia, Jr.

Straub, Wolfgang. **Tapeto-retinal degeneration and clinical electroretinogram.** Klin. Monatsbl. f. Augenh. **125**:566-572, 1954.

In disseminated forms of tapeto-retinal degeneration the b-wave is flat or absent. Four cases are reported in which this characteristic ERG helped to establish the diagnosis of a degenerative disease. (7 figures, 17 references)

Frederick C. Blodi.

Westsmith, R. A., and Abernethy, R. E. **Detachment of retina with use of diisopropyl fluorophosphate (fluropryl) in treatment of glaucoma.** A.M.A. Arch. Ophth. **52**:779-780, Nov., 1954.

A case of wide-angle glaucoma is reported in which a retinal detachment occurred about two months after treatment with DFP was started. The tension has remained normal since a successful operation for retinal detachment.

G. S. Tyner.

12

OPTIC NERVE AND CHIASM

Hummelt, Klaus. **Glioma of the optic nerve with good visual function.** Klin. Monatsbl. f. Augenh. **125**:591-594, 1954.

A six-year-old boy had a glioma which involved the optic nerve from the disc to the optic foramen and yet vision in that eye was 5/7.5 and the field was apparently full. (4 figures, 3 references)

Frederick C. Blodi.

Wagener, H. P. **Lesions of the retina and optic nerve secondary to distant trauma.** Am. J. M. Sc. **228**:226-235, Aug., 1954.

The pertinent literature on Purtscher's disease, traumatic asphyxia, fat embolism, and the "crush syndrome" is reviewed. The writer agrees with the current opinion that the lesions caused by all these conditions except fat embolism have a common pathogenesis; that is, vasospasm secondary to a distant stimulus, combined with tissue anoxia due to the local ischemia. (44 references)

Harry Horwich.

13

NEURO-OPHTHALMOLOGY

Etienne, and Magnard. **Isolated bilateral internal ophthalmoplegia of heredosyphilitic origin.** Ann. d'ocul. **187**:817-824, Sept., 1954.

The authors present a case of bilateral internal ophthalmoplegia in a boy of 10 years. Serologic reactions in blood and spinal fluid were positive. The patient's mother and sister also were Wassermann positive. After treatment with mercuric cyanide, bismuth and penicillin for three weeks, the paralysis of accommodation disappeared, although the iridoplegia remained.

Congenital syphilis is the commonest cause of an isolated bilateral internal ophthalmoplegia. Interstitial keratitis is sometimes present, but other clinical stigmata of congenital lues need not occur. The onset of the affection is usually delayed, and occurs between the ages of 10 and 17 years. In bilateral cases, the lesion is undoubtedly in the third nerve nucleus, but in unilateral cases, it may be peripheral. Other causes are diphtheria, epidemic encephalitis, botulism, measles, chicken pox, trauma, lead and iodine poisoning. (50 references)

John C. Locke

François, J., Stefens, R., and Derouck, A. **Electroretinoencephalography in pigmentary retinopathy.** Ann. d'ocul. **187**:908-937, Oct., 1954.

In more than 80 percent of cases of pigmentary retinopathy, the electroencephalogram showed a diffuse and polymorphic dysrhythmia of a generally low microvoltage, indicative of a generalized

disturbance of the brain. There was no retinal response, either to an isolated light stimulus or to repeated stimuli. There was generally no specific occipital response and no blocking reaction. The electroencephalographic record was not greatly modified by repeated flashings. The colour spectrum, observed during intermittent light stimulation, was very much reduced and modified; the critical fusion frequency was likewise lowered. These subjective modifications seemed to depend principally on the form and intensity of the encephalographic dysrhythmia. The fact that the same electroretinoencephalographic syndrome was found in most of the cases of pigmentary retinopathy, whatever the clinical picture, permits one to suppose that there must be a common underlying cerebroretinal background, resulting from a hereditary disturbance of prosencephalic development. (24 figures, 4 references) John C. Locke.

Imachi, J., Yaso, I., Arisawa, T., and Matsumoto, S. **Results of craniotomy in arachnoiditis and tumors of chiasmal region in Kobe Medical College.** Acta Soc. Ophth. Japan **58**:1365-1377, Oct., 1954.

The authors describe and discuss the results of surgery performed by them during the period from 1947 to 1953 in 91 cases of arachnoiditis and 29 cases of tumors in the chiasmal region. Postoperative death occurred in six of the 29 cases of tumor. A relapse of the arachnoiditis was seen in six of the 91 cases. In 68 cases of both conditions, there was an improvement of vision after surgery. The result of a long term of observation was encouraging and showed that surgery was more reliable than of any other form of treatment. (17 tables, 20 references) Yukihiko Mitsui.

Kyrieleis, Werner. **The diagnostic significance of pupillary disturbances.** Deutsche med. Wchnschr. **79**:1654-1657, Nov. 5, 1954.

The author emphasizes that the sphincter pupillae is supplied by both sympathetic and parasympathetic fibers whereas the much weaker dilator is apparently supplied only by the sympathetic system. He then deals with the anatomic and physiologic bases of the pupillary reaction, the pathways of the light reflex, the convergence reaction, sympathetic and parasympathetic pupillary paralysis, the Argyll Robertson pupil, pupillary disturbances in lesions of the corpora quadrigemina, the Adie syndrome, the amaurotic pupillary reflex, and Wernicke's hemianopic pupillary reflex. William C. Caccamise.

Lowenstein, Otto. **Clinical pupillary symptoms in lesions of the optic nerve, optic chiasm, and optic tract.** A.M.A. Arch. Ophth. **52**:385-403, Sept., 1954.

The author discusses the clinical pupillary symptoms which result from pathologic processes in the "first neuron" of the light reflex arc. Clinical observations are compared to facts derived from experimental lesions in cats and monkeys and here are some of the findings. Anisocoria does not occur in man from a lesion in the optic nerve, chiasm or tract. Qualitative reduction of the pupillary light reflex is a sign common to all lesions of the optic nerve, chiasm and anterior two-thirds of the optic tract. When anisocoria accompanies this type of lesion it indicates that the neighboring structures (sympathetic or parasympathetic fibers in the orbit or cranium) are involved. (11 figures, 3 tables, 10 references) G. S. Tyner.

Norton, E. W. D., and Cogan, D. G. **Spasmus nutans.** A.M.A. Arch. Ophth. **52**:442-446, Sept., 1954.

The cause of spasmus nutans is unknown. The nystagmus in this condition

is characterized by bilateral asymmetry and sometimes by unilaterality. It is fine and rapid and predominately horizontal. The condition was found to persist as long as eight and three quarters years. (1 figure, 6 references) G. S. Tyner.

Payne, Frank. **Neuro-ophthalmology.** A.M.A. Arch. Ophth. **52**:781-806, Nov., 1954. The pertinent literature for the year is reviewed. (80 references)

G. S. Tyner.

Sabri, J. A., and Diab, A. **Plexiform neurofibroma of orbit and lid with defects in walls of orbit and involvement of central nervous system.** A.M.A. Arch. Ophth. **52**:598-603, Oct., 1954.

This rare manifestation of von Recklinghausen's disease is reported in a 15-year-old Arab boy. Pre- and postoperative photographs and histologic sections of the tumor are shown. Twenty-five similar cases have been reported. (4 figures, 16 references) G. S. Tyner.

Sachs, Ernest, Jr. **Arteriographic demonstration of collateral circulation through ophthalmic artery in internal carotid artery thrombosis; report of two cases.** J. Neurosurg. **11**:405-409, July, 1954.

The author demonstrates radiographically the anatomic connections demonstrated previously by Elschnig, and by Walsh and King. In two cases of spontaneous thrombosis of the internal carotid artery proven radiographically, he shows that there is collateral circulation from the homolateral external carotid artery via the ophthalmic artery. In these cases, blindness, diminution of vision, and optic atrophy did not occur. In one of the cases, the dye could be traced via this route, into branches of the internal carotid artery. (3 figures, 10 references)

Harry Horwich.

Tamler, Edward. **Carotid-cavernous fistula with typical signs on contralateral side only.** A.M.A. Arch. Ophth. **52**:433-441, Sept., 1954.

The clinical and autopsy findings in a case of carotid-cavernous fistula with pulsating exophthalmos on the contralateral side only are reported. This phenomenon may be explained by thrombosis of the ophthalmic vein leading from the sinus, or the blocking of egress of blood from the sinus by a dilated internal carotid artery. (3 figures, 9 references)

G. S. Tyner.

Vaernet, Kjeld. **Collateral ophthalmic artery circulation in thrombotic carotid occlusion.** Neurology **4**:605-611, Aug., 1954.

The author presents four cases of thrombosis of the internal carotid artery in the neck, where intracranial filling was demonstrated radiographically, via the external carotid and ophthalmic arteries. The importance of the ophthalmic artery as an additional collateral pathway to cerebral circulation is stressed. Its aid is of special value to the middle cerebral artery, since communication via the circle of Willis is of benefit mainly to the anterior cerebral artery. The author states that one should not, therefore, hasten to therapeutically ligate the external carotid, in thrombosis of the internal. (3 radiographs, 8 references)

Harry Horwich.

14

EYEBALL, ORBIT, SINUSES

Bennett, James E. **Periodic unilateral exophthalmos.** A.M.A. Arch. Ophth. **52**:683-698, Nov., 1954.

A case of recurrent unilateral exophthalmos of three years' duration is reported. The frequency of attack is about once monthly, lasting for 14 days. No definite etiology has been found. The at-

tacks are accompanied by eosinophilia and a decreased excretion of 17-ketosteroids. The attacks can be aborted or prevented by the systemic use of cortisone. (10 figures, 32 references) G. S. Tyner.

DeVoe, Arthur G. **The orbit.** A.M.A. Arch. Ophth. **52**:461-489, Sept., 1954. The year's literature is abstracted and reviewed. (306 references) G. S. Tyner.

Naffziger, H. C. **Progressive exophthalmos.** Roy. Coll. Surg. Ann. **15**:1-24, July, 1954.

In this Hunterian lecture 40 cases of progressive exophthalmos (1930 to 1950) are reviewed. Pathologically, the subjects showed diminished or absent orbital fat and edema, loss of striation, and lymphocytic infiltration of the extra-ocular muscles. The condition was not related to the basal metabolic rate or any particular form of thyroid dysfunction. Unless treated, the exophthalmos may be a threat to life because meningitis and brain abscess may occur. Puffiness of the lids and lacrimation almost invariably occur; and pain or restriction of movement, especially of the gaze upward or outward, are common. The author feels that measurement of orbital resistance is of much more value than is exophthalmometry; and asymmetry of 4 mm. or more is rare. He sees no essential difference in the physiologic responses or orbital pathologic changes between the so-called thyrotoxic and thyrotropic types. He found medication, hormones, radiation, and lid surgery of little help. His procedure is to remove the outer portion of the sphenoid ridge, the pterion, and the posterolateral portion of the orbit, in addition to the roof of the orbit. He no longer unroofs the optic canal. Results were satisfactory in all 40 cases. (14 figures, 38 references)
Harry Horwich.

Nairac, M. L., **Extra-conjunctival implant.** Brit. J. Ophth. **38**:378-379, June, 1954.

An extraconjunctival implant is presented consisting of a main body of acrylic resin, with four brackets of tantalum wire projecting backwards from it. The body is shaped like the segment of a sphere, with its convexity directed backwards, and has a hole in front, similar to the one in Cutler's implant, for receiving the peg of the artificial eye. The brackets project backwards and laterally.

After enucleation the four rectus muscles are brought out through stab incisions in the conjunctiva. The tendon is folded about the bracket and stitched to itself. The brackets are now pushed through the corresponding holes in the conjunctiva and the edges of each incision are stitched together. The results thus far have been good. (4 figures)
Orwyn H. Ellis.

Senà, José A. **Cavernous hemangioma of the orbit.** Arch. oftal. Buenos Aires **29**:215-224, April, 1954.

Angioma cavernosum of the orbit is a relatively common, slowly growing, soft, congenital tumor, which usually develops within the muscle cone, gives rise to a progressive, reducible proptosis and is made up of a connective-tissue framework enclosing large spaces filled with blood. If spontaneous fibrous transformation does not occur, the eyeball may be endangered and surgical removal required.

The case of a 53-year-old man is described, in which a left exophthalmos had been noticed for the last ten years. Vision was limited to 15/200 on the left side and was normal on the right. Fundus examination of the affected left eye showed a pale disc with blurred margins and an atrophic macular lesion. Arteriography failed to reveal any connection between the orbital process and the carotid system. Extirpation through a transpalpebroconjunctival route entailed no

difficulty and was followed by a good cosmetic result; as could be expected from the preoperative clinical picture, vision improved but slightly. Pathologic examination established the diagnosis. (6 figures, 4 references)

A. Urrets-Zavalia, Jr.

Tomb, E. H., and Gearhart, D. F. **A new magnetic orbital implant.** A.M.A. Arch. Ophth. **52**:763-768, Nov., 1954.

The totally buried implant offers the best results because of the absence of discharge and the slight tendency to extrusion. The magnetic implant overcomes the disadvantage of decreased movement. The implant used and technique for insertion are described. The rectus muscles are sutured to the implant with tantalium sutures. Tenon's capsule and the conjunctiva cover the muscles and implant. A pressure dressing is not necessary postoperatively. The artificial eye is not inserted until eight weeks after operation. (2 figures, 5 references) G. S. Tyner.

Williamson-Noble, F. A. **Diseases of the orbit and its contents, secondary to pathological conditions of the nose and para-nasal sinuses.** Roy. Coll. Surg. Ann. **15**:46-64, July, 1954.

In reviewing the anatomy of the orbit as related to the paranasal sinuses, the writer notes that edema of the lids is common in sinus infections because of the large number of veins linking the two. He states that edema of the lid is the most significant sign of ethmoiditis in infants and children. He believes that 70 percent of all orbital inflammations are due to paranasal sinusitis. Various classifications of orbital inflammation are given, and some methods of measuring proptosis. Treatment consists of the use of appropriate antibiotics, and surgical drainage of localized pus. In differential diagnosis one considers pseudotumor, which often is secondary to inflammation of a paranasal sinus; mucocele, which is commoner in young people, and usually is not secondary to inflammation; malignant disease of the sinus, especially squamous cell carcinoma of the ethmoids and antra; and nonmalignant processes such as thyroid exophthalmos. (10 figures, 14 references) Harry Horwich.

15

EYELIDS, LACRIMAL APPARATUS

deVoe, A. G., and Horwich, H. **Congenital entropion and tetrastichiasis of upper lids, palpebral hyperpigmentation, and mental deficiency.** A.M.A. Arch. Ophth. **52**:865-870, Dec., 1954.

The patient is a 32-year-old Negress with other congenital anomalies. The entropion had produced corneal scarring. The condition was satisfactorily treated surgically. A modified Streatfield-Snellen procedure was done. The literature on the subject is reviewed. (12 figures, 10 references) G. S. Tyner.

Gartner, S., and Chamlin, M. **Lid mobilization and tarsorrhaphy for massive proptosis.** A.M.A. Arch. Ophth. **52**:234-239, Aug., 1954.

The authors describe a method for a permanent closure of the lids in which the external canthal ligament is cut and the outer portions of both lids are undermined. This procedure mobilizes the lids and facilitates approximation of their edges. The palpebral fissure is then narrowed as desired by tarsorrhaphy medially and laterally. (5 figures)

G. S. Tyner.

NEWS ITEMS

Edited by Donald J. Lyle, M.D.
601 Union Trust Building, Cincinnati 2, Ohio

News items should reach the editor by the 12th of the month but, to receive adequate publicity, notice of postgraduate courses, meetings, and so forth should be received at least three months before the date of occurrence.

Announcements

Toronto refresher course

The University of Toronto, Faculty of Medicine, announces a refresher course in eye, ear, nose, and throat surgery to be given April 11th to 15th at Toronto. Guest surgeons will be Dr. Alson E. Braley, Iowa City, Iowa; Dr. Frank B. Walsh, Baltimore; Dr. Edmund P. Fowler, New York; and Dr. Dean M. Lierle, Iowa City. The course will be given for a minimum of 10 and a maximum of 30 students. For further information address: Dean of the Faculty of Medicine, University of Toronto, Toronto, Ontario.

V Pan-American congress

The V Pan-American Congress of Ophthalmology will be held in Santiago, Chile, January 9 to 14, 1956. Twelve symposia have been organized to discuss the following subjects:

Collagen diseases, glaucoma, infantile glaucoma, secondary glaucoma, strabismus, detachment of the retina, psychosomatic ophthalmology, tropical diseases, physiopathology and surgery of the crystalline lens, plastic surgery, visual fields and neuro-ophthalmology, and intraocular tumors.

Participants in the different symposia are equally divided in numbers between ophthalmologists from the United States and Canada and from Latin America. Special provision will be made to enable English-speaking delegates to the congress to understand papers presented by their Latin America confréres, and vice versa.

For further information address:

Dr. Rene Contardo
930 Huerfanos
Santiago, Chile

Societies

Puget Sound Academy

Officers and committees for 1955 of the Puget Sound Academy of Ophthalmology and Otolaryngology are:

President, Dr. William H. Ludwig; president-elect, Dr. Russell T. Horsfield; secretary-treasurer, Dr. Williard F. Goff; trustees, Dr. W. C. Cameron, Dr. J. A. Weber, Dr. E. D. Anderson, Dr. C. D. F. Jensen, Dr. I. Finkenstein, Dr. W. F. Goff, and Dr. A. G. Hanson.

Auditing committee, Dr. L. L. Bull, Dr. J. E. Clark, Dr. L. L. McCoy, and Dr. R. Wightman; legislation and public relations committee, Dr. E. F. McElmeel, Dr. H. L. Goss, Dr. H. F. Thorlakson, and Dr. J. A. Weber; library committee, Dr. E. D. Anderson, Dr. F. F. Ackerman, Dr. C. E. Maas, and Dr. W. J. Stellwagen; membership and ethics committee, Dr. J. M. Shiach, Dr. R. A. Campbell, Dr. E. G. Dorland, and Dr. A. W. Howe; program committee, Dr. A. G. Hanson, Dr. J. W. Phillips, Dr. G. H. Drumheller, Dr. G. N. Haffly, and Dr. H. L. Maier; conservation of vision committee, Dr. R. C. Laughlin, Dr. C. E. Benson, and Dr. W. C. Cameron; conservation of hearing committee, Dr. J. F. Tolan; entertainment committee, Dr. I. Finkenstein, Dr. J. R. Campbell, Dr. C. V. Lundvick, and Dr. P. B. Smith.

Egypt meeting

The annual meeting of the Ophthalmological Society of Egypt was held at the Memorial Ophthalmic Laboratory, Giza, Egypt, on March 4th and 5th.

Joint Carolinas meeting

Plans have been completed for a joint meeting of the North Carolina Eye, Ear, Nose, and Throat Society and the South Carolina Society of Ophthalmology and Otolaryngology at Columbia, South Carolina, on September 12, 13, and 14, 1955. Headquarters will be the Columbia Hotel.

Guest speakers on ophthalmology will be Dr. E. W. D. Norton, New York; Dr. Frank Carroll, New York; and Dr. William B. Clark, New Orleans.

Irish ophthalmological meeting

The Irish Ophthalmological Society will hold its annual meeting in Dublin on May 12, 13, and 14, 1955. The Montgomery Lecture will be delivered by Dr. H. Arruga of Barcelona at five o'clock on Thursday, May 12th, in the Royal College of Surgeons Ireland.

Cleveland meetings

Dr. P. Robb McDonald, Philadelphia, was guest speaker at the November meeting of the Cleveland Ophthalmological Club; his topic was "Causes of failure in glaucoma surgery." At the January meeting, Dr. Alston Callahan, Birmingham, spoke on "Surgical removal of orbital tumors." Dr. Ralph O. Rychener, Memphis, discussed "Treatment of diseases of the lacrimal apparatus; With special emphasis on plastic dacryocystorhinostomy," at the February meeting. The fourth meeting of the society will be on April 12th at which time the residents from Lakeside, Saint Luke's, Cleveland City, and

Crile Veterans Administration hospitals and from the Cleveland Clinic will present papers.

Brooklyn award

At the 132nd regular meeting of the Brooklyn Ophthalmological Society, the guest speaker was Dr. Charles L. Schepens, Boston, who discussed "Recent advances in retinal detachment surgery."

The Brooklyn society offers an annual award of $100.00 for the best contribution in ophthalmology (paper, instrument or otherwise, as judged by the society's award committee) by a resident ophthalmologist or an ophthalmologist in practice no longer than five years in New York City, all boroughs, and Long Island. The contribution must be submitted in writing and must not exceed 2,000 words.

American Goiter Association

The American Goiter Association will hold its 1955 meeting at the Skirvin Hotel, Oklahoma City, Oklahoma, on April 28th, 29th, and 30th. The program for the meeting will consist of papers and discussions dealing with the physiology and diseases of the thyroid gland.

Memphis convention

Guest speakers in ophthalmology at the Memphis Eye, Ear, Nose, and Throat convention were:

Dr. Frederick C. Cordes, San Francisco: "Diabetes: Its effect on the eye," "Evaluation of our present knowledge of endocrine exophthalmos," and "Congenital cataract and congenital cataract surgery."

Dr. F. Bruce Fralick, Ann Arbor, Michigan: "Minor ophthalmic surgery," "Surgical anatomy of operations for glaucoma," "Periorbital lesions," and "Transconjunctival approach for removal of hemangioma of the orbit."

Dr. Harold G. Scheie, Philadelphia: "Gonioscopy," "The removal of the iris by iridectomy," "The medical treatment of glaucoma," and "The surgical treatment of glaucoma."

Wills clinical conference

On the program of the seventh annual clinical conference of the staff and ex-residents of the Wills Eye Hospital, Philadelphia, were:

"An evaluation of the tuberculin reaction in uveitis," Dr. Harold A. Hanno and Dr. Philip G. Spaeth; "Macular holes in retinal separation: Their significance and surgery," Dr. Arthur H. Keeney; "Mechanism of Diamox action," Dr. H. Green, Dr. I. H. Leopold, Dr. A. F. Calnan, C. Bocher, J. Sawyer, A. Rosenberg, and L. Waters; "The possible role of mucopolysaccharides in ocular disease," Dr. P. Carmichael, and Dr. I. H. Leopold; "Steroid content of aqueous humor," Dr. H. Green, Dr. I. H. Leopold, and J. Sawyer; "Anatomic considerations in vertical muscle surgery," Dr. Walter H. Fink. Dr. Carroll R. Mullen presided at this first session.

With Dr. Warren S. Reese presiding, papers were read at the second session by: Dr. Enrique Wudka and Dr. I. H. Leopold, "Mechanism of action of iridectomy in glaucoma: Experimental studies"; Dr. Benjamin Wolpaw, "Incidence of undiagnosed glaucoma in the adult population"; Dr. E. Howard Bedrossian, "Tonography: Comparison of rate of formation and rate of outflow of aqueous in glaucoma"; Dr. Edmund B. Speath, "The evaluation of reoperation for glaucoma."

At the third session, Dr. Patrick J. Kennedy presiding, were presented: Dr. William M. McCarty, "Latent nystagmus"; Dr. Arthur J. Bedell, "A rare type of bilateral choroiditis: Kodachrome record for 12 years"; Dr. Nathan S. Schlezinger and Dr. Robert E. Murto, "An evaluation of ocular signs and symptoms in verified cerebral aneurysms"; Dr. James E. Purnell, "Corneal transplantation in keratoconus."

The guest-of-honor at the conference was Dr. Leighton F. Appleman, attending surgeon at Wills Eye Hospital from 1924 to 1939, and consulting surgeon since 1939. The Arthur J. Bedell Lecture was delivered by Dr. Algernon B. Reese of New York, whose subject was "The diagnosis and treatment of orbital tumors and simulating lesions."

Dallas Southern clinical conference

Dr. Paul A. Chandler, Boston, and Dr. Harold G. Scheie, Philadelphia, were guest speakers for ophthalmology at the fourth annual spring clinical conference of the Dallas Southern Clinical Society. Dr. Chandler spoke on "Treatment of traumatic lesions of the eye," "Diagnosis and treatment of subacute types of angle-closure glaucoma," "The significance of vitreous opacities: Especially in relation to detachment of the retina," and "Types and treatment of open-angle glaucoma." The subjects of Dr. Scheie's papers were: "Gonioscopy and anatomy of the angle of the anterior chamber," "Wound closure of cataract," and "The surgical treatment of retinal detachment."

Nassau county meeting

At the February meeting of the Nassau Ophthalmological Society at Garden City, New York, Dr. Gerald Fonda presented a paper on "Low-vision aids." The next meeting of the society will be held on April 25th.

Dallas guest speaker

Dr. Michael J. Hogan, San Francisco, was honor guest at the February meeting of the Dallas Academy of Ophthalmology and Otolaryngology. Dr. Hogan presented papers on "Observations on the pathology and management of certain postcataract complications," and "Certain observations on the diagnosis and management of patients with uveitis."

Pennsylvania meeting

The 13th annual meeting of the Pennsylvania Academy of Ophthalmology and Otolaryngology will be held May 18 to 21, 1955, at the Hotel Traymore, Atlantic City, New Jersey. This meeting is being held jointly with the New Jersey Society of Ophthalmology and Otolaryngology and the West

Virginia Academy of Ophthalmology and Otolaryngology.

Dr. James H. Delaney, president of the academy, will preside. The guest-of-honor for the meeting will be the president-elect of the American Medical Association, Dr. Elmer Hess.

The meeting will consist of study clubs and general sessions. The faculty for the study clubs will be members of the societies. The general sessions will be given by members of the societies and also invited guests.

Those ophthalmologists invited to participate are: Dr. Samuel Blank, Philadelphia; Dr. F. Bruce Fralick, Ann Arbor; Dr. Glen G. Gibson, Philadelphia; Dr. Peter C. Kronfeld, Chicago; Dr. Edmund B. Spaeth, Philadelphia; Dr. John M. McLean, New York; Dr. James S. Shipman, Dr. I. S. Tassman, and Dr. P. Robb McDonald, Philadelphia; Dr. John S. McGavic, Bryn Mawr; Dr. Harvey E. Thorpe, Pittsburgh; Dr. Edwin B. Dunphy, Boston; Dr. Charles L. Thomas, Cleveland; Dr. Irving H. Leopold, Philadelphia; Dr. Murray F. McCaslin, Pittsburgh; Dr. William E. Krewson, Philadelphia; Dr. William C. Owens, Baltimore; Dr. Raynold N. Berke, New York.

Appointment

In July, 1955, having reached the academic retirement age, Alan C. Woods steps down as professor of ophthalmology and director of the Department of Ophthalmology in The Johns Hopkins University, and as ophthalmologist-in-chief of The Johns Hopkins Hospital and director of the Wilmer Institute. As all of us, here and abroad, know, he has served these posts with the utmost distinction, with credit to himself, and honor to his university. He will be succeeded by Alfred E. Maumenee, at present professor of surgery (ophthalmology), Stanford University School of Medicine.

Dr. Woods was graduated from The Johns Hopkins University, B.A., 1910, M.D., 1914. In 1915, he was appointed as associate in the Department of Ophthalmology at Johns Hopkins and progressed through all of the academic grades to the position of full professor in 1946. He served as an ophthalmologist in the U. S. Army Medical Corps, 1917-1918, and was discharged as major. Since then he has frequently acted as consultant to the Surgeon General, and as member and chairman of several national committees, the most important being the Committee on Ophthalmology, National Research Council. He is a member and fellow of many professional societies, past president (1947) of the Academy of Ophthalmology and Otolaryngology, and president (1956) of the American Ophthalmological Society. He has justly received many honors, the medal of the Section on Ophthalmology, A.M.A., the Howe Medal of the American Ophthalmological Society, honorary LL.D. from Hampden-Sydney College, and, in 1950, was made an honorary fellow of the Royal College of Surgeons of Edinburgh. His writings on ophthalmic subjects are known throughout the world.

Dr. Maumenee received his B.A. from the University of Alabama in 1934 and his M.D. from Cornell in 1938. He served as resident in ophthalmology (Wilmer Institute) at The Johns Hopkins Hospital from 1938 to 1944, when he was appointed as associate professor in ophthalmology. He filled this post until 1948 when he was called to Stanford University to head up the Department of Ophthalmology there. In this time, he has contributed much to our science, especially in the scientific aspect of corneal transplantation, as co-editor of the *Atlas on Ophthalmic Pathology*, and co-editor of *Progress in Ophthalmology*. His surgical skill and judgment, his scientific qualifications and interest in the experimental phase of ophthalmology, his teaching ability and the lucid clarity of his writings assure us that one of the key posts in American ophthalmology will be well filled.

Personals

The 1954 Leslie Dana Medal for Prevention of Blindness, sponsored by the Saint Louis Society for the Blind in co-operation with the Association for Research in Ophthalmology and the National Society for the Prevention of Blindness, has been awarded to Col. E. A. Baker, managing director of the Canadian National Institute for the Blind.

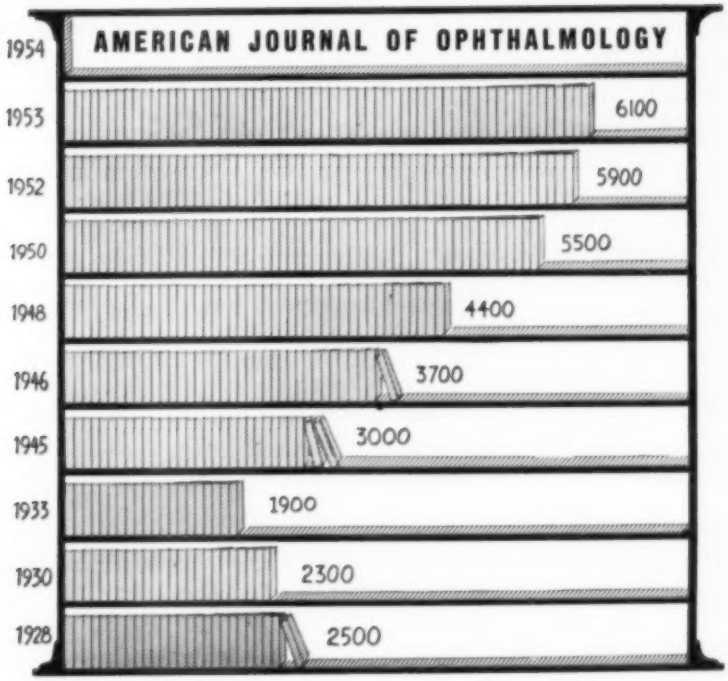
Dr. Brittain Ford Payne, New York, has been chosen an Honorary Fellow of the Philippine Ophthalmological and Otolaryngological Society, in recognition of his help, friendship, and interest in the society.

UNIVERSITY OF MICHIGAN POSTGRADUATE COURSE IN OPHTHALMOLOGY

The Faculty of Medicine of the University of Michigan offers a refresher course in Ophthalmology from April 18 to 20, 1955. The instruction will consist of didactic lectures emphasizing the practical aspects of ophthalmology.

The guest surgeons will be Dr. A. J. Elliot, Professor and Head of the Department of Ophthalmology, University of Toronto, Toronto, Ontario; Dr. Lorand V. Johnson, Clinical Professor in Ophthalmology, Western Reserve University, Cleveland; Dr. Philip Meriwether Lewis, Professor of Ophthalmology, University of Tennessee, Memphis; Dr. Brittain Ford Payne, Clinic Professor of Ophthalmology, New York University, New York; Dr. Hunter H. Romaine, Professor of Ophthalmology, Polyclinic Hospital and Medical School, New York; Dr. Edmond L. Cooper, Assistant Surgeon, Harper Hospital, Detroit; Dr. Cecil W. Lepard, Assistant Professor of Ophthalmology, Wayne University, Detroit; Dr. John F. Holt, Professor of Radiology, University of Michigan, Ann Arbor. The staff of the Department of Ophthalmology in the University will contribute to the course.

Requests for enrollment and further information should be made to Dr. John M. Sheldon, Department of Postgraduate Medicine, University Hospital, Ann Arbor, Michigan, not later than February 15, 1955.



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International Journal of Ophthalmology
Journal international d'Ophtalmologie
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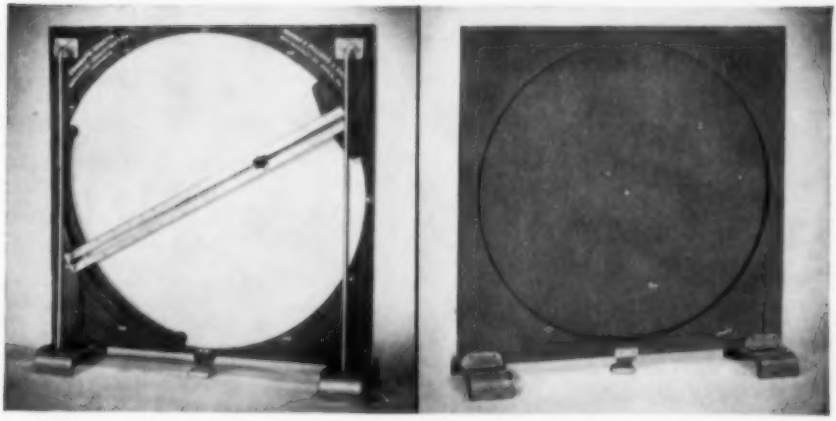

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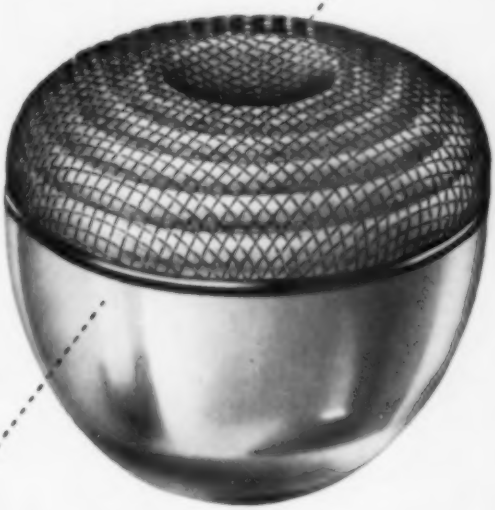

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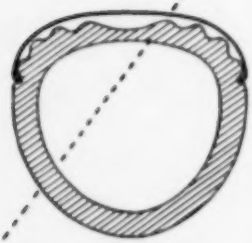

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